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USADTC ltr, 14 Mar 1979

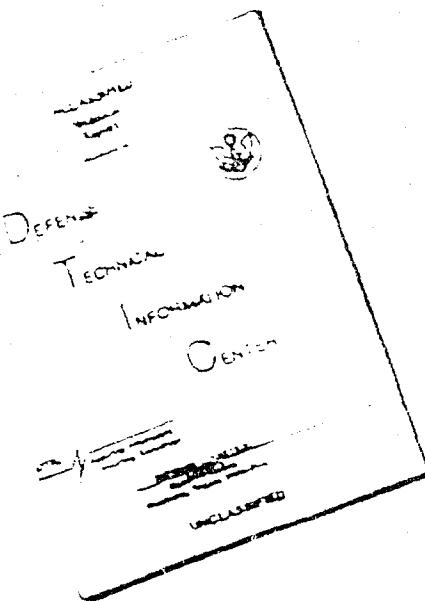
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BOOK 2

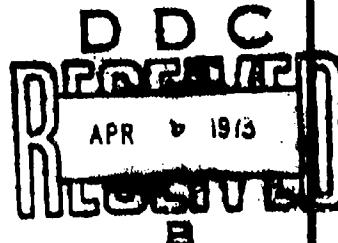
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BALLUTE STABILIZATION FOR VARIOUS MUNITION CONFIGURATIONS

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GOODYEAR AEROSPACE CORPORATION

TECHNICAL REPORT AFATL-TR-72-75 BOOK 2
APRIL 1972



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EGLIN AIR FORCE BASE, FLORIDA

Ballute Stabilization For Various Munition Configurations

J. J. Graham

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FOREWORD

This project was conducted by the Goodyear Aerospace Corporation, Akron, Ohio, under Contract F08635-70-C-0050 with the Air Force Armament Laboratory, Eglin Air Force Base, Florida. This effort was conducted during the period from 18 December 1969 to 30 April 1972. The program monitor for the Armament Laboratory was Captain Mark O. Schlegel (DLNL).

This technical report has been reviewed and is approved.


DALE M. DAVIS
Director, Guns and Rockets Division

ABSTRACT

One hundred and nineteen Ballute stabilized bomb configurations were studied to determine the feasibility of ram air-inflated Ballutes as stabilizers or decelerators for various tactical missions. Both subsonic and transonic wind tunnel tests were conducted to define static and dynamic aerodynamic characteristics.

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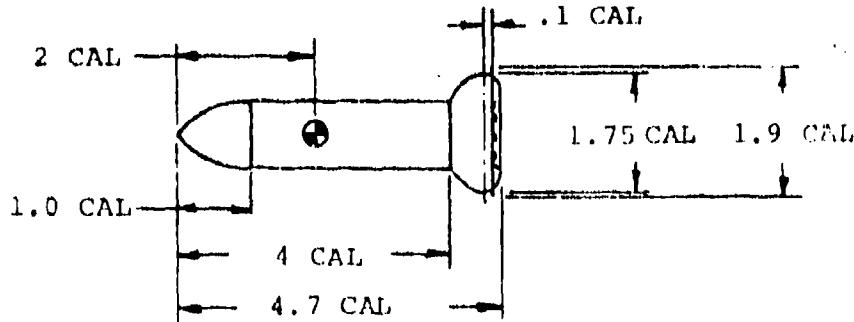
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<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	336
Plotted	337
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Barble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

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Figure 206. Model Specifications for Configuration 96

TABLE CX. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 96

VELOCITY(FT/SEC)	= 200.00	REFERENCE LENGTH(FT)	= 0.1250
DENSITY(SLUGS/CU FT)	= 0.002467	REFERENCE AREA(SQ FT)	= 0.0125
DYNAMIC PRESSURE(LB/SQ FT)	= 47.34	C.G.(CALIBERS)	= 4.0000
REYNOLDS NUMBER	= 0.1975E-05	ALPHA SLEET(DEGREES)	= 1.000

ALPHA (DEGREES) SET TRUE	C1	C0	CN	CA	CM	SM (CALIBERS)
-5.0 -4.0	-0.264	0.723	-0.332	0.767	0.338	0.306
-4.0 -3.0	-0.248	0.760	-0.300	0.741	0.279	-0.673
-3.0 -2.0	-0.149	0.743	-0.187	0.735	0.212	-0.611
-2.0 -1.0	-0.116	0.760	-0.142	0.755	0.185	-0.424
-1.0 0.0	0.0	0.760	-0.013	0.760	0.114	-0.912
0.0 1.0	0.050	0.727	0.050	0.727	0.010	-6.565
1.0 2.0	0.050	0.775	0.063	0.775	0.020	0.294
2.0 3.0	0.149	0.793	0.176	0.787	0.035	0.560
3.0 4.0	0.132	0.775	0.173	0.768	0.062	-2.175
4.0 5.0	0.182	0.733	0.237	0.778	-0.010	-0.041
5.0 6.0	0.215	0.809	0.284	0.786	-0.014	-0.051
6.0 7.0	0.281	0.809	0.364	0.776	-0.082	-0.227
7.0 8.0	0.330	0.809	0.427	0.763	-0.128	-0.300
8.0 9.0	0.446	0.826	0.557	0.756	-0.179	-0.321
9.0 10.0	0.512	0.859	0.640	0.768	-0.254	-0.347
10.0 11.0	0.694	0.842	0.829	0.769	-0.343	-0.413
11.0 12.0	0.661	0.908	0.822	0.766	-0.378	-0.460
12.0 13.0	0.769	0.925	0.936	0.747	-0.428	-0.498
13.0 14.0	0.793	0.942	0.984	0.719	-0.454	-0.461
14.0 15.0	0.826	0.941	1.041	0.762	-0.465	-0.447
15.0 16.0	0.942	1.024	1.174	0.745	-0.563	-0.474
16.0 17.0	0.958	1.059	1.199	0.705	-0.647	-0.540
17.0 18.0	0.958	1.057	1.225	0.731	-0.701	-0.572
18.0 19.0	0.941	1.024	1.259	0.665	-0.760	-0.613
19.0 20.0	1.057	1.023	1.356	0.587	-0.841	-0.621
20.0 21.0	1.140	1.029	1.444	0.635	-0.843	-0.623

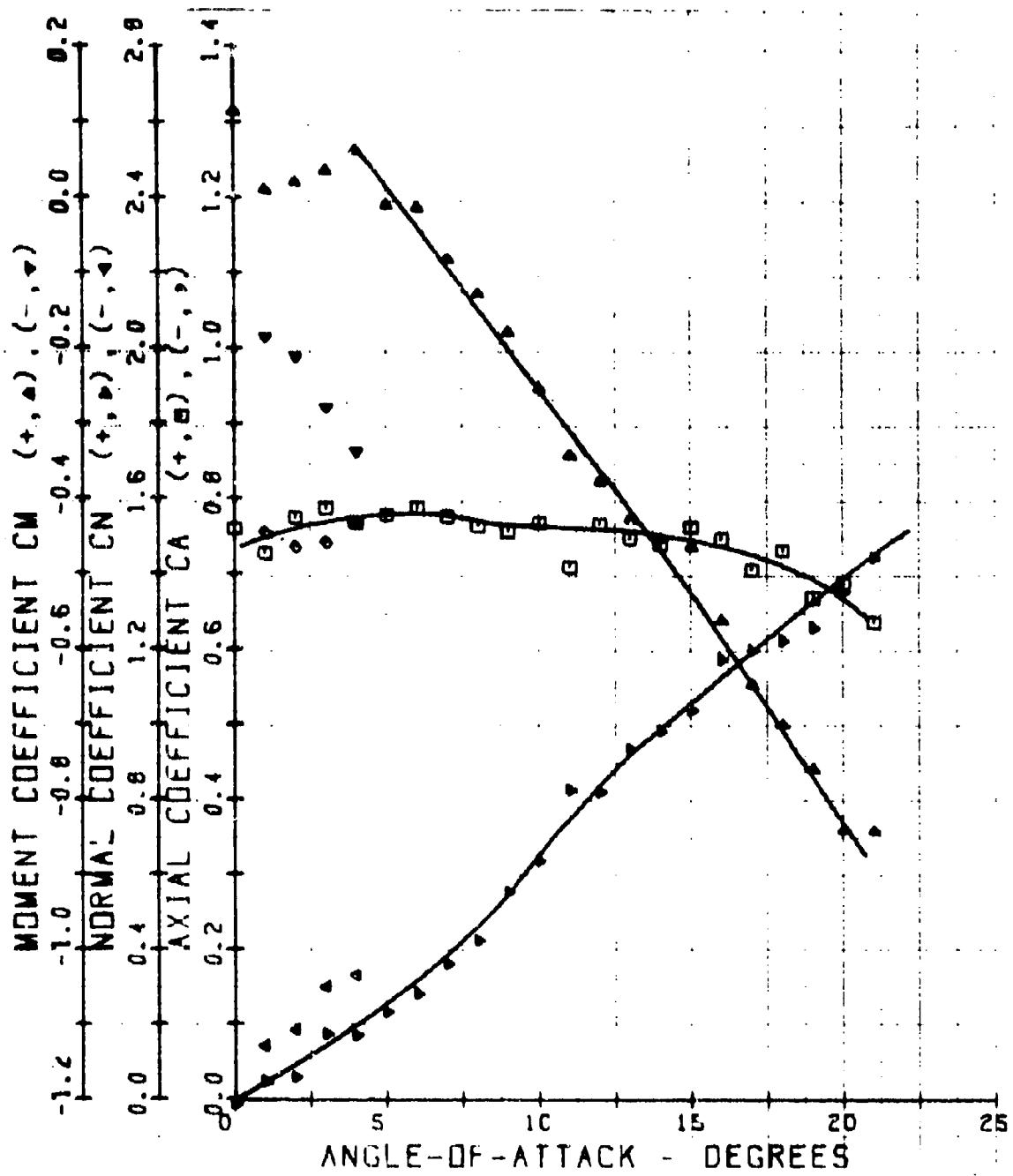
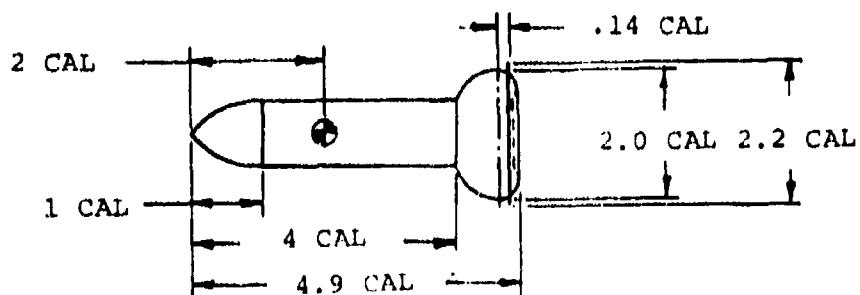


Figure 207. Graphic Static Aerodynamic Test Data: Configuration 96
(Test No. E 1)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	339
Plotted	340
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 208. Model Specification for Configuration 97

TABLE CXI. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 97

VELOCITY(FT/SEC)	= 200.00	REFERENCE LENGTH(FT)	= 0.1250
DENSITY(SLUGS/CU FT)	= 0.002467	REFERENCE AREA(SQ FT)	= 0.0123
DYNAMIC PRESSURE(LB/SQ FT)	= 47.62	CL ₀ (CALIBERS)	= 4.0000
REYNOLDS NUMBER	= 0.1530E-09	ALPHA SHIFT(DEGREES)	= 2.200

ALPHA (DEGREES)	CL	C _D	C _N	CA	CM	SM (CALIBERS)	
SET TRUE							
-9.0	-2.0	-0.197	1.201	-0.301	1.180	0.175	-0.468
-8.0	-1.5	-0.099	1.159	-0.180	1.159	0.025	6.356
-7.0	-0.9	-0.115	1.213	-0.179	1.210	-0.074	-0.549
-6.0	-0.2	-0.049	1.180	0.103	1.186	-0.117	-0.376
-5.0	1.0	-0.099	1.234	0.077	1.236	-0.196	-8.271
-4.0	2.0	0.092	1.234	0.082	1.234	-0.239	-1.984
-3.0	3.0	0.200	1.218	0.120	1.216	-0.280	11.053
-2.0	4.0	0.382	1.185	0.124	1.181	-0.228	-0.975
-1.0	5.0	0.197	1.201	0.201	1.189	-0.433	-1.664
0.0	6.0	0.214	1.218	0.233	1.200	-0.525	-1.759
1.0	7.0	0.281	1.251	0.344	1.222	-0.578	-1.491
2.0	8.0	0.392	1.185	0.484	1.141	-0.675	-1.395
3.0	9.0	0.494	1.267	0.644	1.198	-0.807	-1.253
4.0	10.0	0.643	1.234	0.712	1.147	-0.845	-1.191
5.0	11.0	0.292	1.267	0.783	1.159	-0.363	-1.229
6.0	12.0	0.723	1.217	0.120	1.174	-1.065	-1.150
7.0	13.0	0.823	1.132	0.071	1.200	-1.236	-1.153
8.0	14.0	0.949	1.041	1.164	1.200	-1.376	-1.183
9.0	15.0	1.05	1.448	1.203	1.208	-1.449	-1.200
10.0	16.0	1.037	1.459	1.362	1.170	-1.543	-1.134
11.0	17.0	1.071	1.465	1.612	1.134	-1.652	-1.170
12.0	18.0	1.073	1.675	1.932	1.113	-1.805	-1.260
13.0	19.0	1.151	1.570	1.503	1.100	-1.530	-1.198
14.0	20.0	1.171	1.570	1.336	1.147	-1.945	-1.189
15.0	21.0	1.171	1.613	1.677	1.129	-2.080	-1.241
16.0	22.0	1.171	1.666	1.931	1.085	-2.089	-1.141

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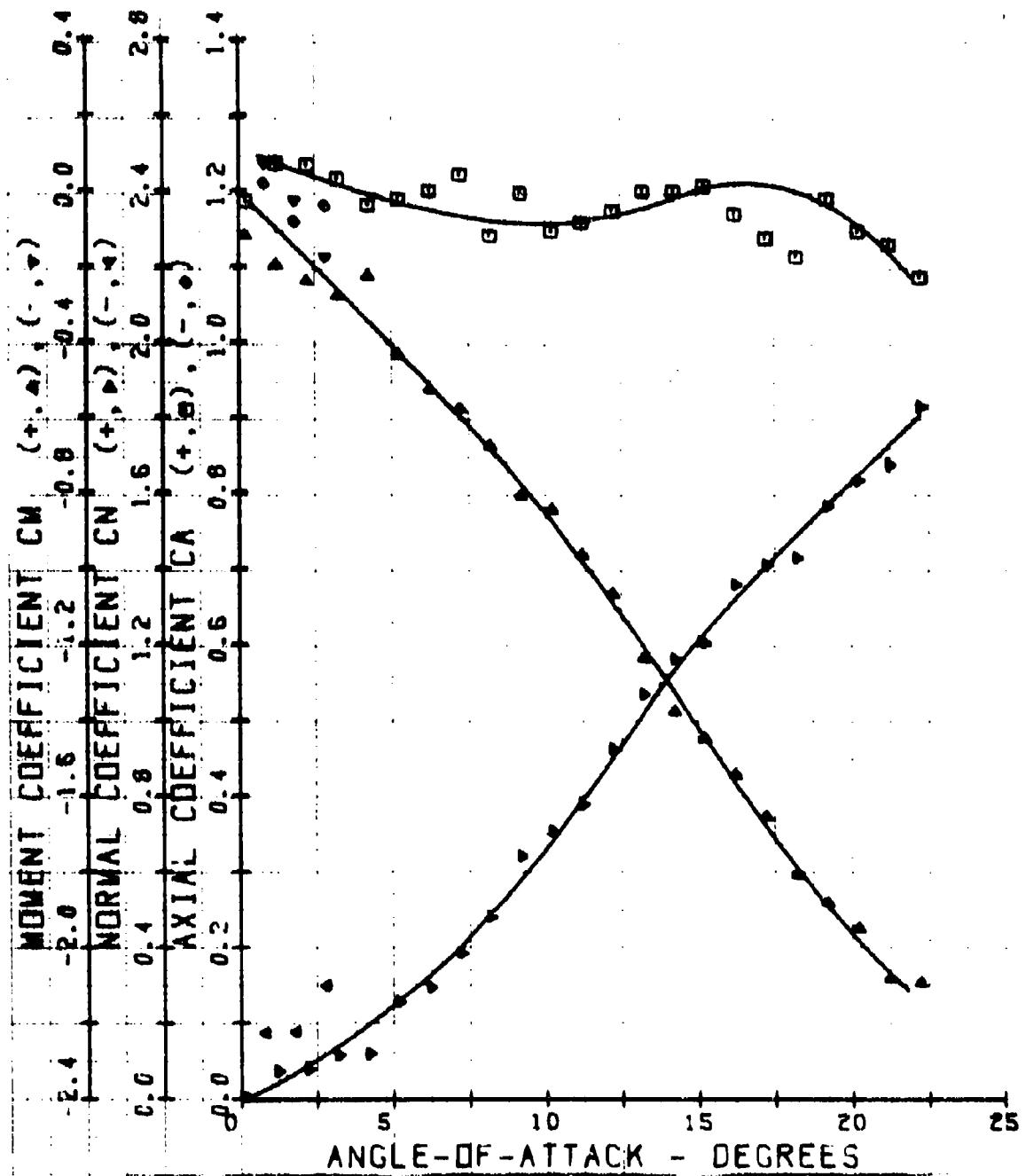
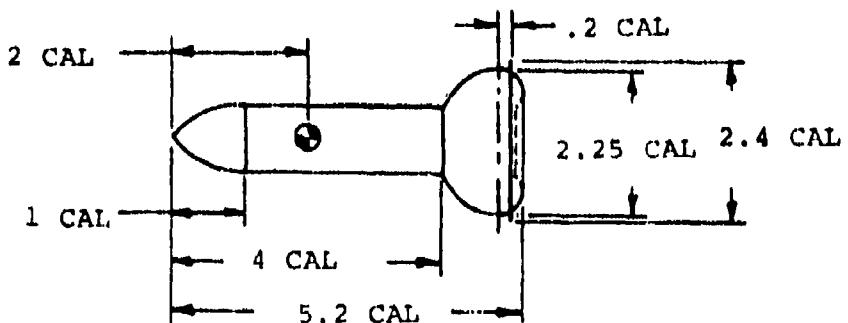


Figure 209. Graphic Static Aerodynamic Test Data: Configuration 97
 (Test No. E 2)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	342
Plotted	343
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

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Remarks

Figure 210. Model Specifications for Configuration 98

TABLE CXII. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 98

VELOCITY(FT/SEC)	= 210.00	REFERENCE LENGTH(FT)	= 0.1250
DENSITY(SLUGS/CU FT)	= 0.02431	REFERENCE AREA(SQ FT)	= 0.0123
DYNAMIC PRESSURE(LBS/CU FT)	= 4.767	CALIBERS	= 0.0000
REYNOLDS NUMBER	= 1.1933E+06	ALPHA SETT(DEGREES)	= 2.200

ALPHA (DEGREES) SET TRUE	CL	CD	CH	CA	CM	SM (CALIBERS)
-5.0 -2.8	-0.279	2.447	-0.491	2.414	1.034	16.345
-4.0 -1.9	-0.181	2.332	-0.343	2.314	1.012	-1.831
-3.0 -0.8	0.0	2.102	-0.110	2.079	0.531	-1.889
-2.0 0.2	0.082	2.152	0.07	2.153	0.297	-12.802
-1.0 1.2	0.0	2.283	-0.040	2.233	0.116	0.826
0.0 2.2	-0.034	2.251	-0.033	2.250	0.214	1.606
1.0 3.2	0.016	2.257	0.056	2.266	0.208	-22.417
2.0 4.2	0.016	2.257	0.096	2.265	-0.098	-0.774
3.0 5.2	0.394	2.184	0.903	2.161	-0.181	-0.355
4.0 6.2	0.411	2.217	0.564	2.183	-0.429	-0.760
5.0 7.2	0.394	2.332	0.596	2.289	-0.607	-1.019
6.0 8.2	0.460	2.297	0.698	2.239	-0.777	-1.114
7.0 9.2	0.476	2.250	0.747	2.175	-0.941	-1.260
8.0 10.2	0.553	2.283	0.871	2.133	-0.929	-1.067
9.0 11.2	0.838	2.283	1.134	2.124	-1.484	-1.253
10.0 12.2	0.887	2.217	1.258	2.030	-1.579	-1.255
11.0 13.2	1.068	2.217	1.471	1.973	-1.737	-1.181
12.0 14.2	1.051	2.234	1.493	1.966	-1.848	-1.238
13.0 15.2	1.133	2.283	1.618	1.970	-2.053	-1.272
14.0 16.2	1.117	2.316	1.646	1.977	-2.020	-1.229
15.0 17.2	1.330	2.257	1.872	1.849	-2.144	-1.146
16.0 18.2	1.270	2.283	1.876	1.937	-2.409	-1.284
17.0 19.2	1.445	2.236	2.035	1.716	-2.507	-1.233
18.0 20.2	1.312	2.197	1.977	1.622	-2.619	-1.325
19.0 21.2	1.563	2.382	2.251	1.756	-2.751	-1.227
20.0 22.2	1.564	2.349	2.256	1.679	-3.037	-1.347

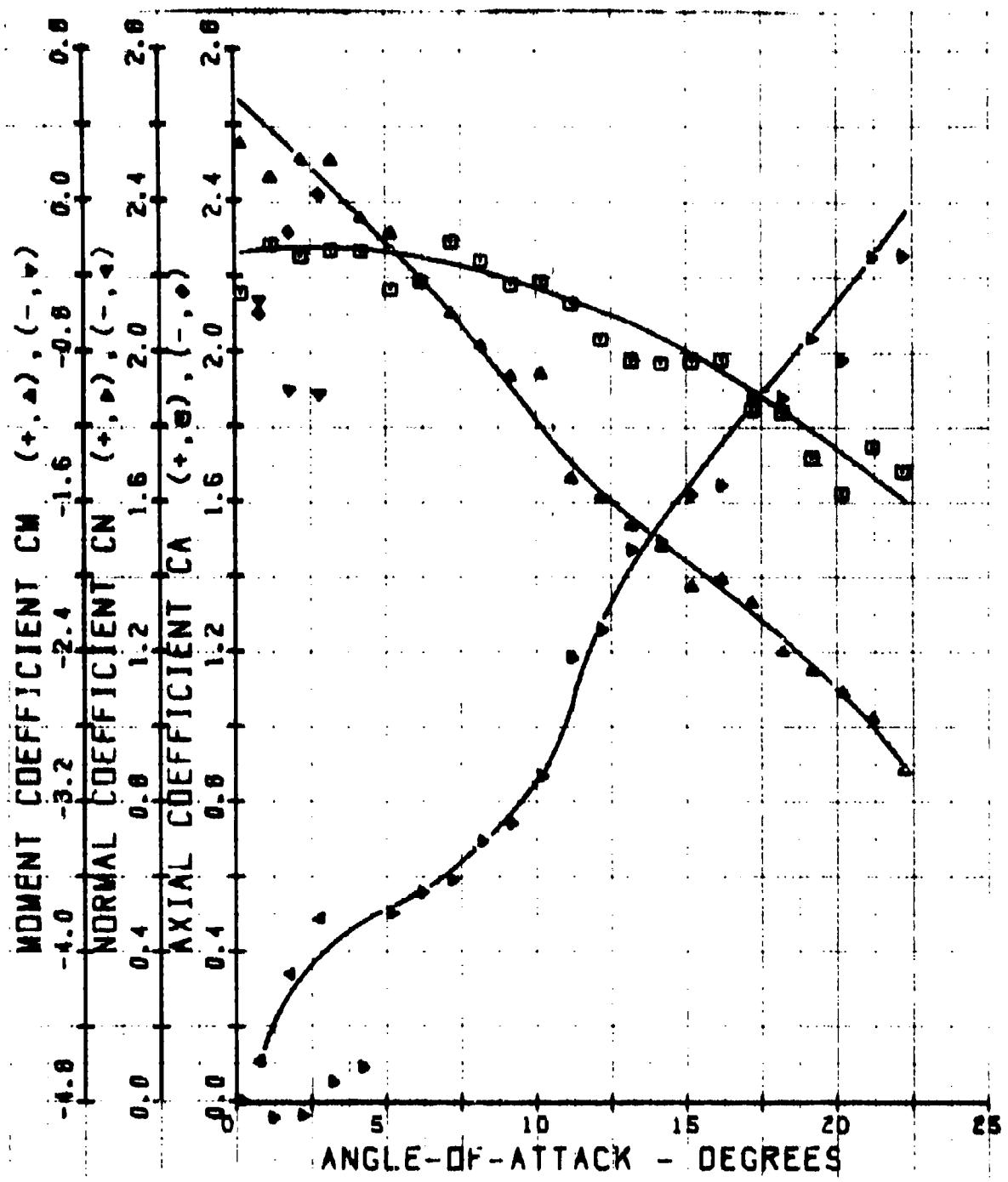
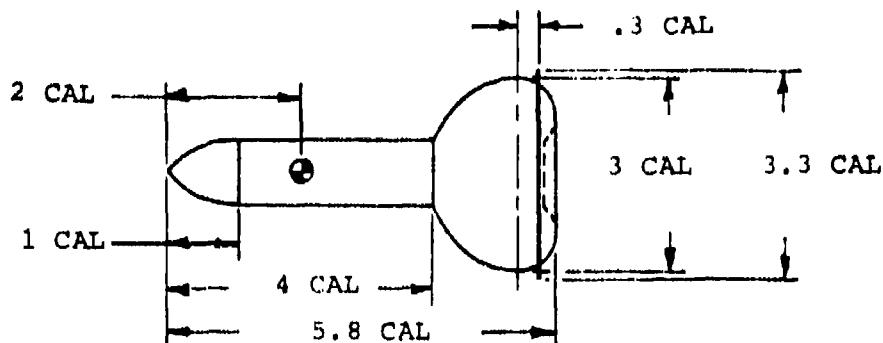


Figure 211. Graphic Static Aerodynamic Test Data: Configuration 98
(Test No. E 3)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	345
Plotted	346
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 212. Model Specifications for Configuration 99

TABLE CXIII. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 99

VELOCITY(FT/SEC.)	= 200.00	REFERENCE LENGTH(FT)	= 0.1250
DENSITY(SLUGS/CU FT)	= 0.002494	REFERENCE AREA(SQ FT)	= 0.0123
DYNAMIC PRESSURE(LB/SQ FT)	= 49.88	C.G.(CALIBERS)	= 4.0000
REYNOLDS NUMBER	= 0.1592E 06	ALPHA SHIFT(DEGREES)	= 1.800

ALPHA (DEGREES) SET	CL	CD	CN	CA	CM	SM (CALIBERS)
TRUE						
-5.0	-3.0	-0.229	5.735	-0.729	5.693	1.912
-4.0	-2.2	-0.163	5.735	-0.563	5.710	1.430
-3.0	-1.2	0.0	5.686	-0.298	5.678	0.781
-2.0	-0.2	-0.049	5.646	-0.247	5.581	-0.198
-1.0	0.8	0.605	5.572	0.507	5.581	-1.613
0.0	1.8	0.556	5.817	0.555	5.817	-1.545
1.0	2.8	0.817	5.784	0.918	5.759	-2.387
2.0	3.8	0.817	5.947	1.024	5.915	-3.142
3.0	4.8	0.333	5.784	1.135	5.733	-3.584
4.0	5.8	1.242	5.915	1.651	5.814	-4.041
5.0	5.8	1.291	5.947	1.804	5.812	-4.441
6.0	7.0	1.274	6.144	1.910	5.977	-4.854
7.0	8.0	1.340	6.175	2.082	5.967	-5.080
8.0	9.0	1.356	6.074	2.189	5.830	-11.789
9.0	10.0	1.471	6.078	2.403	5.773	-5.664
10.0	11.0	1.372	6.029	2.399	5.699	-5.959
11.0	12.0	1.307	6.193	2.464	5.829	-6.777
12.0	13.0	1.291	6.094	2.529	5.693	-6.710
13.0	14.0	1.716	5.931	3.006	5.393	-7.619
14.0	15.0	1.363	5.833	3.218	5.204	-7.599
15.0	16.0	2.010	5.882	3.463	5.162	-8.266
16.0	17.0	2.187	5.784	3.697	4.957	-9.008
17.0	18.0	2.157	5.947	3.801	5.057	-9.260
18.0	19.0	2.132	5.734	3.869	4.825	-9.418
19.0	20.0	2.435	5.849	4.200	4.738	-9.915
20.0	21.0	2.467	5.882	4.330	4.684	-10.422

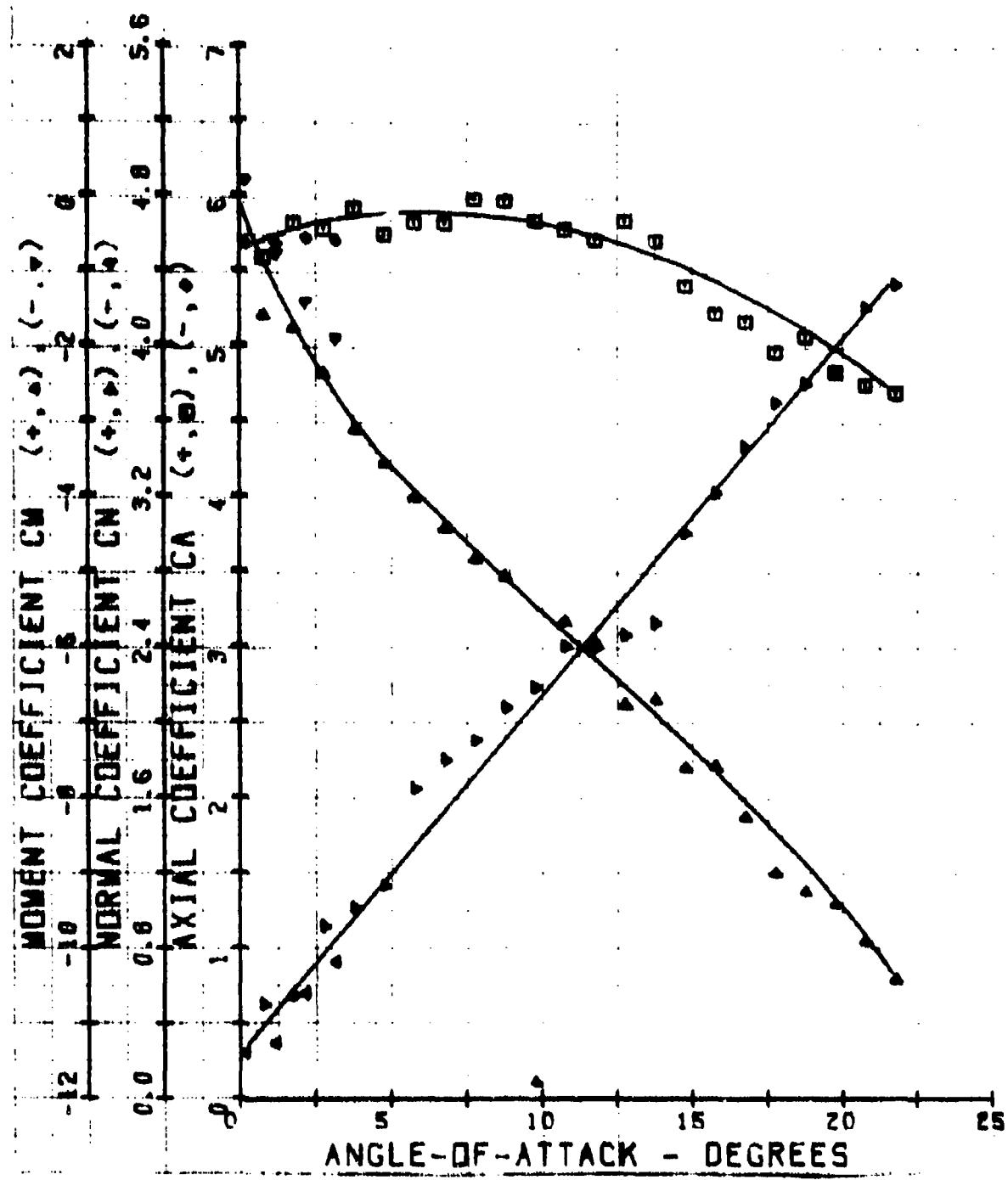
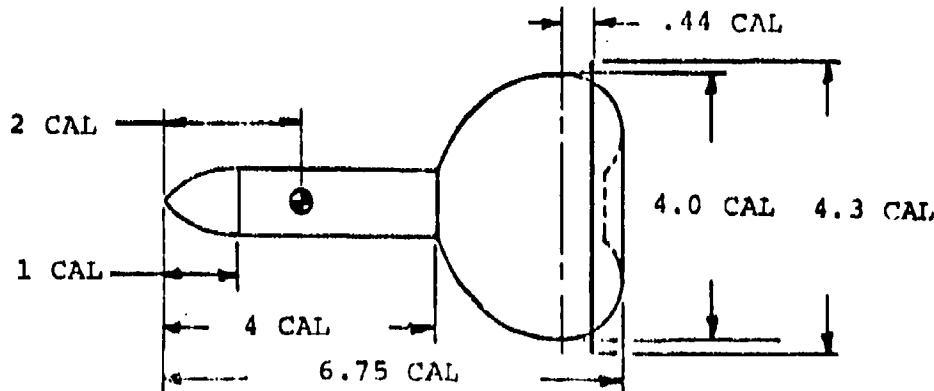


Figure 213. Graphic Static Aerodynamic Test Data: Configuration 99
(Test No. E 4)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	348
Plotted	349
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 214. Model Specifications for Configuration 100

TABLE CXIV. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 100

VELOCITY(FT/SEC)	= 20.00	REFERENCE LENGTH(FT)	= 0.1250
DENSITY(SLUGS/CU FT)	= 0.02498	REFERENCE AREA(SQ FT)	= 0.0125
DYNAMIC PRESSURE(LB/SQ FT)	= 4.7676	L.D. (CALEBERS)	= 4.0000
REYNOLDS NUMBER	= 0.15740	ALPHA-SHEET (DEGREES)	= -0.800

ALPHA (DEGREES) SET TRUE	C1	C2	C3	C4	C5	C6	C7
-5.0	-5.8	-1.387	8.417	-2.115	8.265	8.114	-4.309
-4.0	-4.8	-1.387	8.417	-1.970	8.320	8.155	-3.023
-3.0	-3.8	-1.044	8.776	-1.502	8.710	5.444	-2.640
-2.0	-2.8	-0.734	8.238	-1.021	8.287	5.122	-1.752
-1.0	-1.8	-0.489	8.237	-0.634	8.277	3.361	-0.040
0.0	-0.8	-0.359	8.075	-0.352	8.075	1.707	-6.564
1.0	0.2	-0.082	8.320	0.064	8.320	-1.646	-2.265
2.0	1.2	0.0	8.846	0.302	8.841	-0.328	-2.417
3.0	2.2	0.326	8.169	0.753	8.120	-2.622	-3.798
4.0	3.2	0.816	8.483	1.405	8.425	-4.235	-2.925
5.0	4.2	1.360	8.452	1.793	8.326	-6.083	-5.073
6.0	5.2	1.305	8.456	2.181	8.207	-7.069	-3.241
7.0	5.2	1.501	8.385	2.511	8.140	-7.059	-2.411
8.0	7.2	1.223	8.776	2.433	8.521	-8.334	-3.426
9.0	8.2	1.745	8.483	3.051	8.145	-9.152	-3.000
10.0	9.2	1.876	8.401	3.506	7.945	-10.006	-3.026
11.0	10.2	1.711	8.829	3.362	8.371	-10.309	-3.067
12.0	11.2	1.876	8.433	3.598	7.917	-11.543	-3.208
13.0	12.2	1.088	8.403	3.942	7.776	-12.200	-3.094
14.0	13.2	2.610	8.483	4.506	7.610	-13.516	-2.748
15.0	14.2	2.610	8.483	4.710	7.510	-14.156	-3.004
16.0	15.2	2.173	8.433	5.004	7.327	-15.472	-3.092
17.0	16.2	2.736	8.320	5.240	7.078	-16.741	-3.199
18.0	17.2	3.042	8.646	5.612	7.205	-17.463	-3.109
19.0	18.2	3.263	8.320	5.793	6.825	-18.917	-3.256
20.0	19.2	3.752	8.320	5.371	6.535	-19.794	-4.107

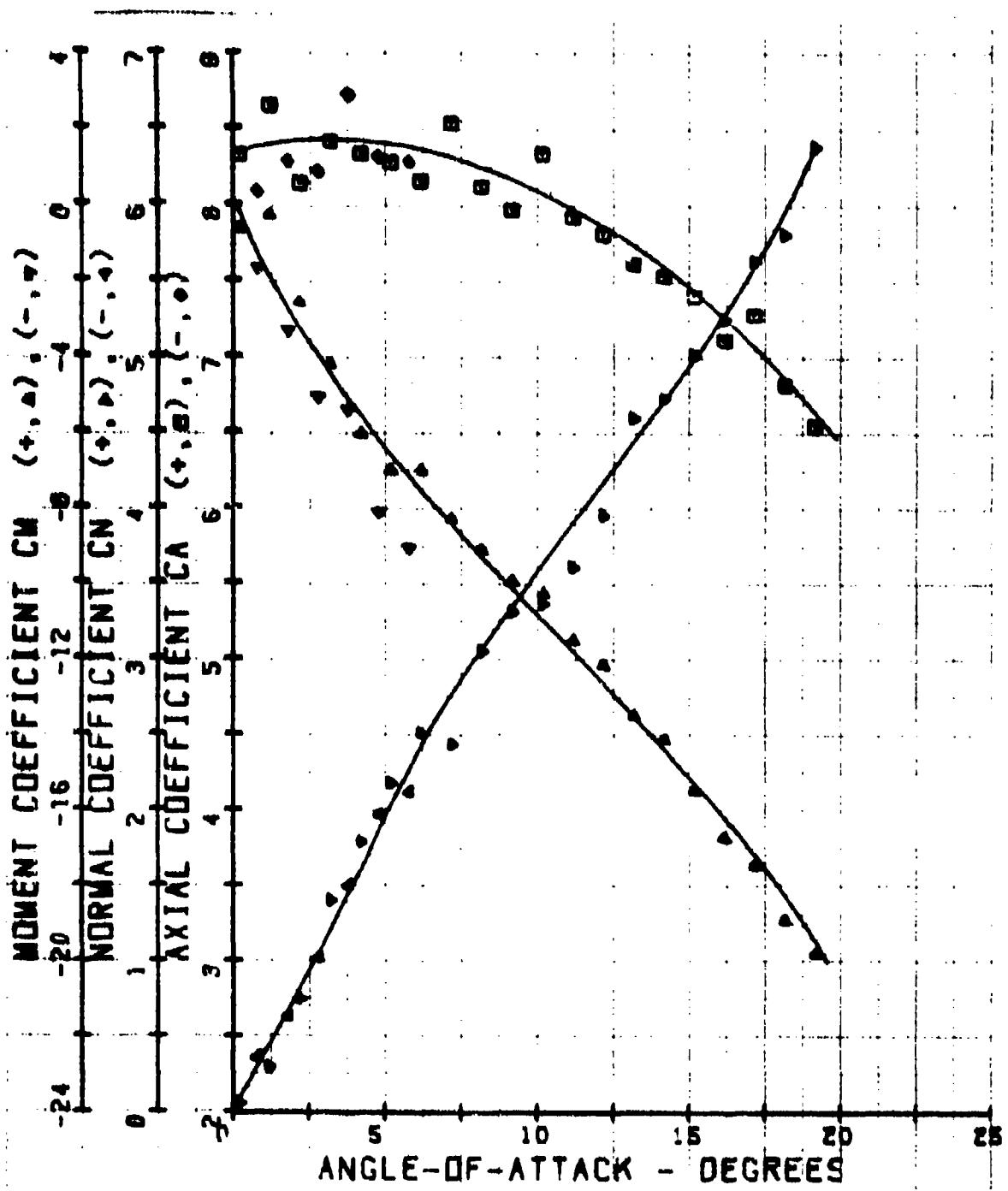
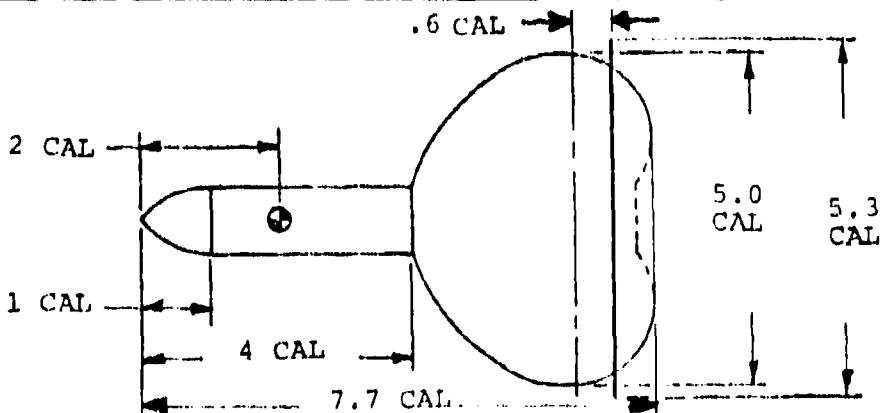


Figure 215. Graphic Static Aerodynamic Test Data: Configuration 100.
(Test No. E 5)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	351
Plotted	352
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 216. Model Specifications for Configuration 101

TABLE CXV. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 101

VELOCITY(FT/SEC)	= 200.00	REFERENCE LENGTH(FT)	= 0.1250
DENSITY(SLUGS/CU FT)	= 0.002501	REFERENCE AREA(SQ FT)	= 0.0123
DYNAMIC PRESSURE(LB/SQ FT)	= 50.02	C.G.(CALIBERS)	= 4.0000
REYNOLDS NUMBER	= 0.1590E 06	ALPHA SHIFT(DEGREES)	= 2.800

ALPHA (DEGREES) SET TRJ	CL	C	CN	CA	CM	SM (CALIBERS)
-5.0 -2.1	-0.652	13.686	-1.842	13.578	7.788	0.054
-4.0 -1.3	-0.153	13.524	-1.106	13.479	5.197	-16.739
-3.0 -0.2	1.153	13.524	-0.545	13.514	0.838	-2.764
-2.0 0.8	1.303	14.338	0.802	14.375	-1.130	-1.722
-1.0 1.3	0.815	13.849	0.573	13.861	-3.171	-24.481
0.0 2.8	1.629	13.849	1.629	13.849	-7.981	1.384
1.0 3.3	2.115	14.012	2.362	13.973	-3.255	-2.046
2.0 4.8	2.617	14.664	3.117	14.564	-12.542	-11.106
3.0 5.8	3.422	14.175	4.159	13.977	-18.541	-4.458
4.0 6.8	3.585	14.990	4.621	14.703	-20.248	-4.382
5.0 7.3	2.444	14.590	3.741	14.720	-20.859	-5.576
6.0 8.8	3.916	15.153	5.471	14.661	-25.720	-4.700
7.0 9.1	4.725	14.990	6.516	14.303	-25.923	-3.978
8.0 10.6	3.585	14.990	5.632	14.345	-26.752	-4.747
9.0 11.3	6.073	14.990	6.368	14.164	-26.981	-4.237
10.0 12.8	4.725	14.990	7.256	13.942	-29.385	-4.050
11.0 13.4	4.725	15.642	7.622	14.453	-29.311	-3.845
12.0 14.4	4.684	15.316	7.965	13.965	-26.631	-3.343
13.0 15.4	4.725	15.315	7.414	14.007	-29.646	-3.999
14.0 16.4	4.098	15.316	8.447	13.579	-31.618	-3.743
15.0 17.5	4.725	15.968	8.676	14.201	-32.409	-3.727
16.0 18.5	4.725	15.642	8.853	13.734	-33.634	-3.799
17.0 19.5	4.311	15.468	8.875	13.984	-33.045	-3.723
18.0 20.5	4.684	15.316	9.381	13.056	-33.990	-3.623
19.0 21.5	5.751	15.479	9.514	12.992	-35.980	-3.666
20.0 22.5	4.684	15.805	9.998	13.180	-33.874	-3.388

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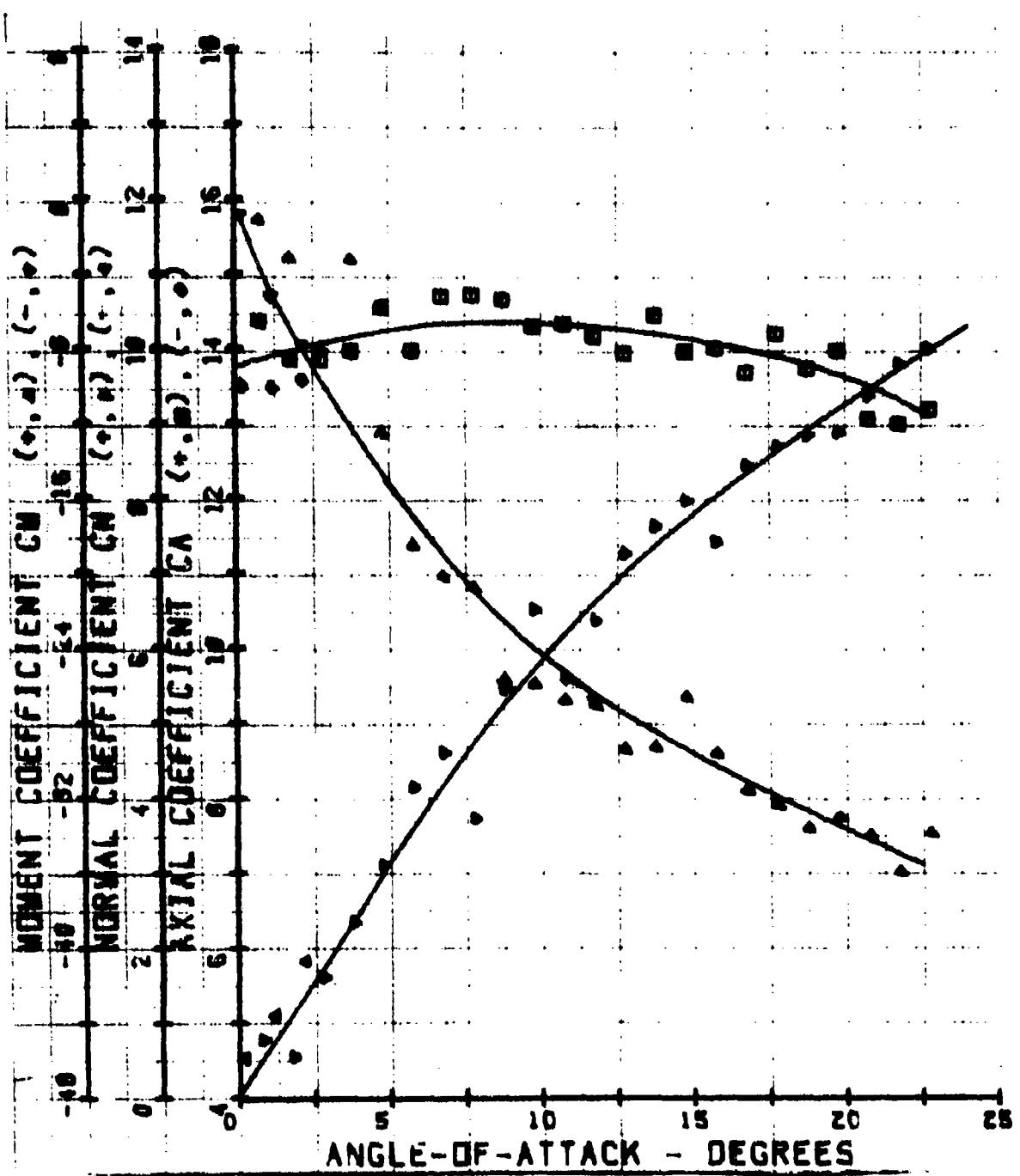
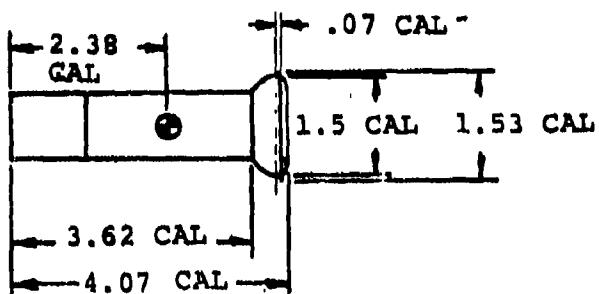


Figure 217. Graphic Static Aerodynamic Test Data: Configuration 101
(Test No. E 6)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	354
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boat tail = none
 Strakes (8) = none

Remarks

Figure 218. Model Specification for Configuration 102

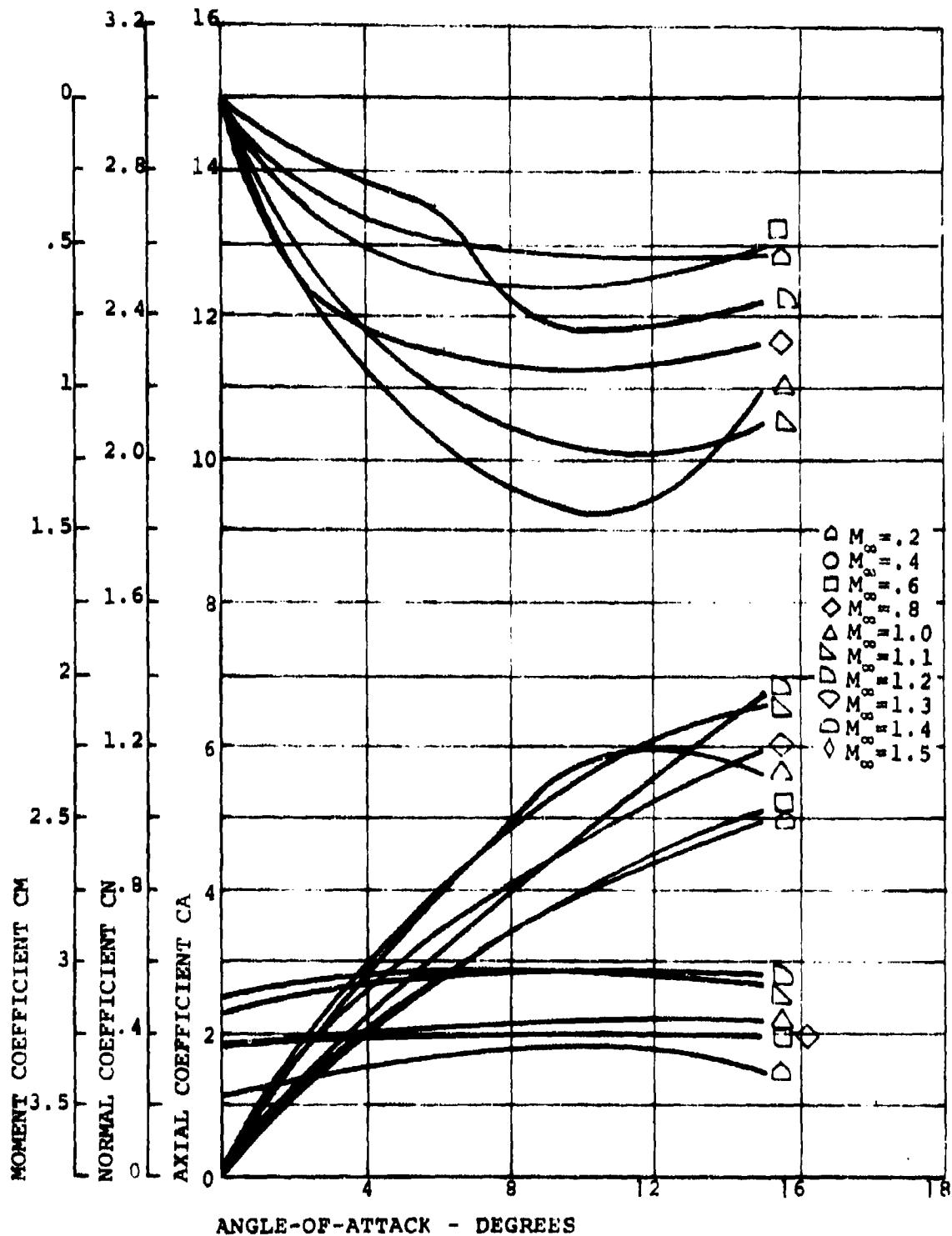
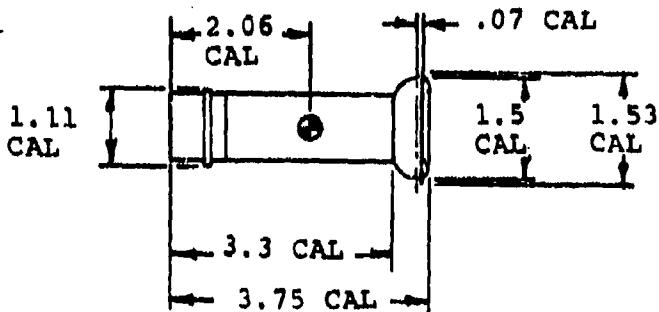


Figure 219. Graphic Static Aerodynamic Test Data: Configuration 102
(Test No. E 7)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	356
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 220. Model Specifications for Configuration 103

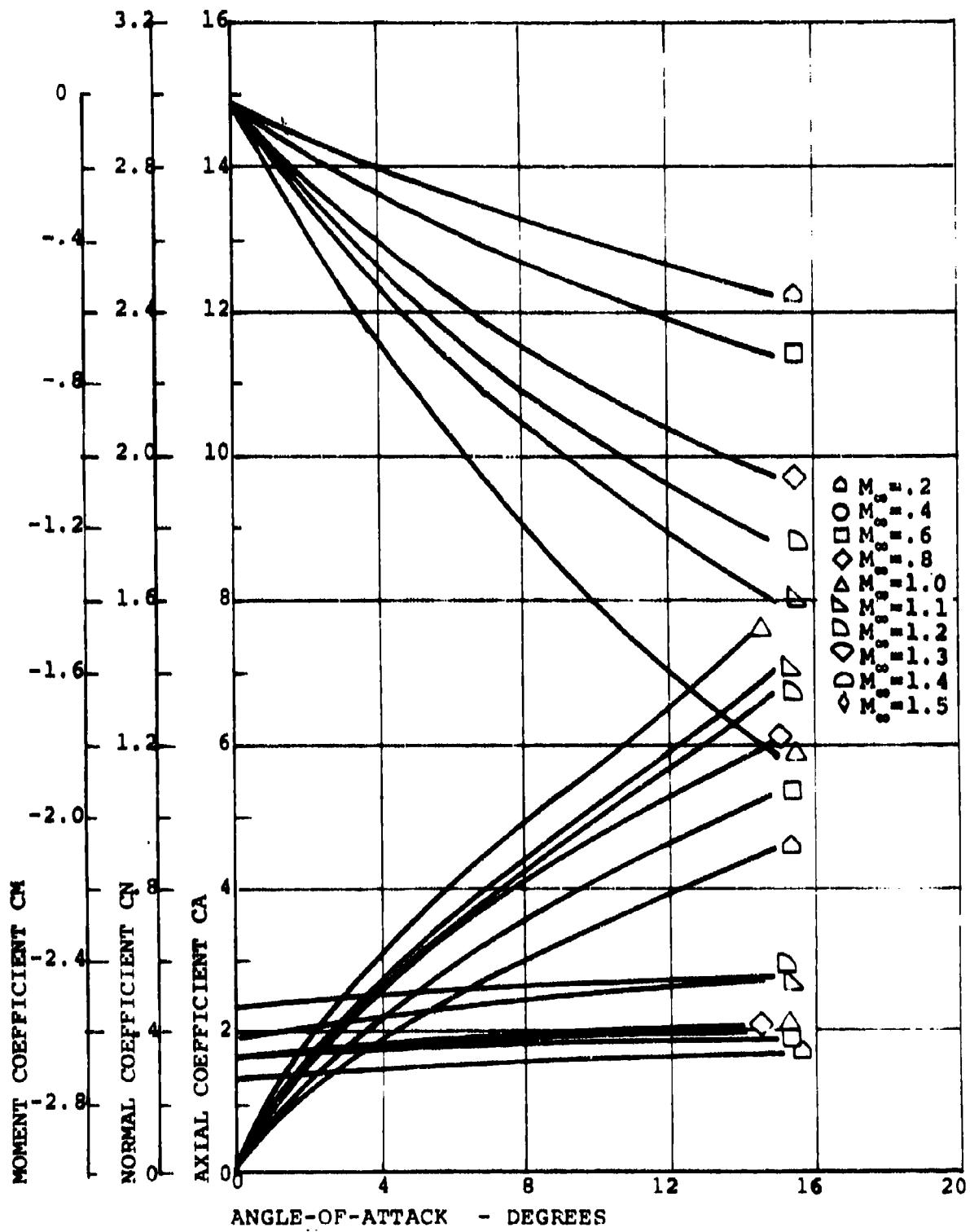
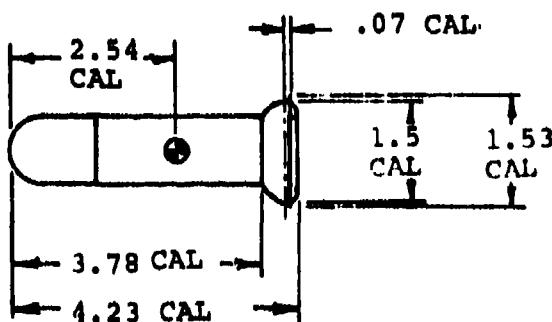


Figure 221. Graphic Static Aerodynamic Test Data: Configuration 103
(Test No. E 8)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	358
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 222. Model Specifications for Configuration 104

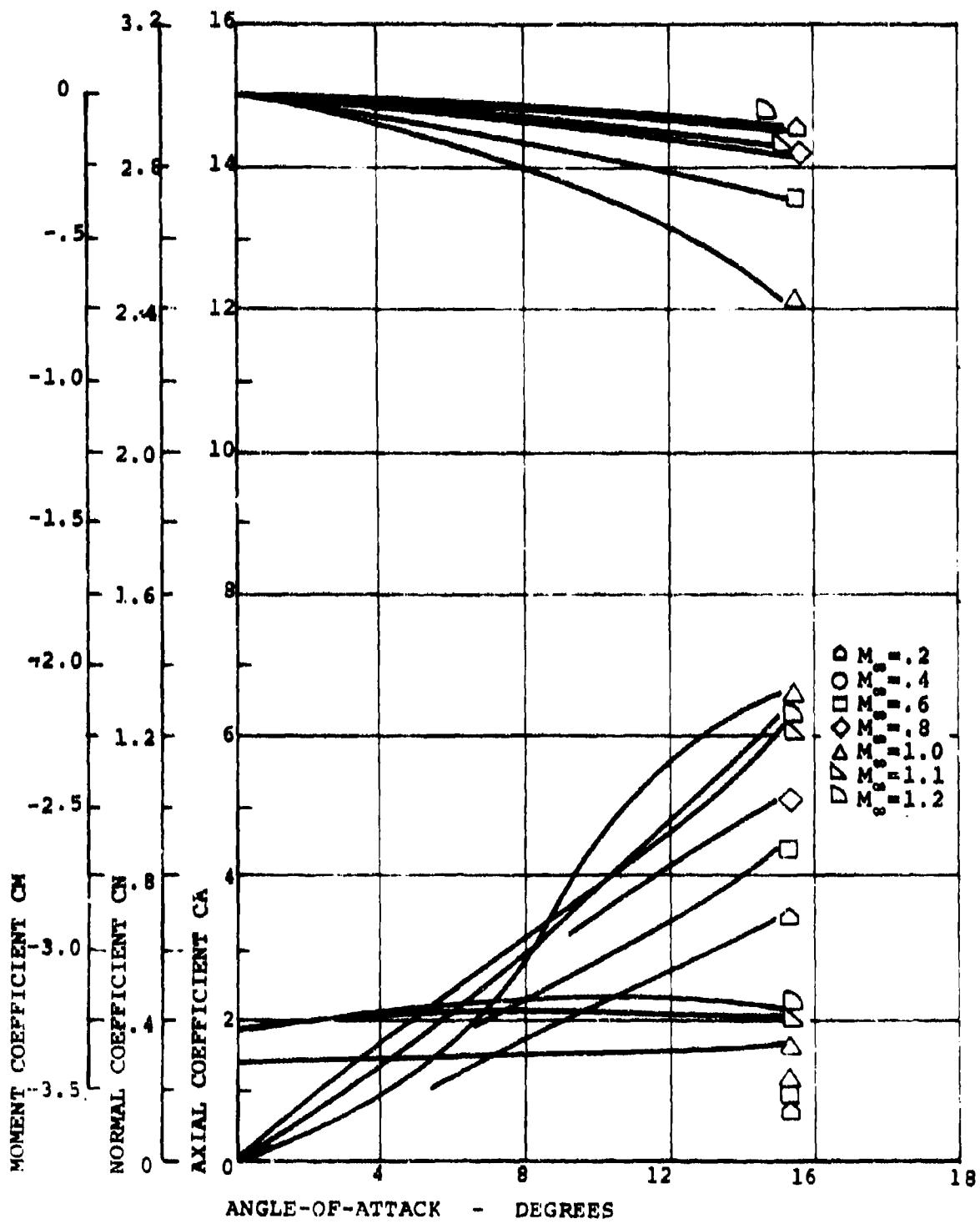
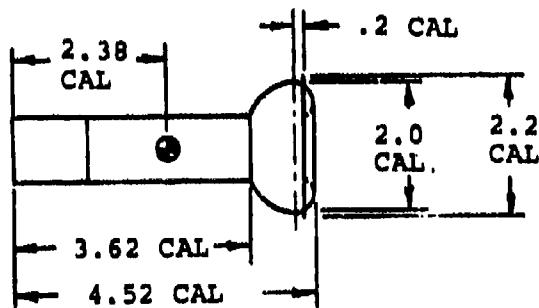


Figure 223. Graphic Static Aerodynamic Test Data: Configuration 104
(Test No. E 9)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	360
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 224. Model Specification for Configuration 105

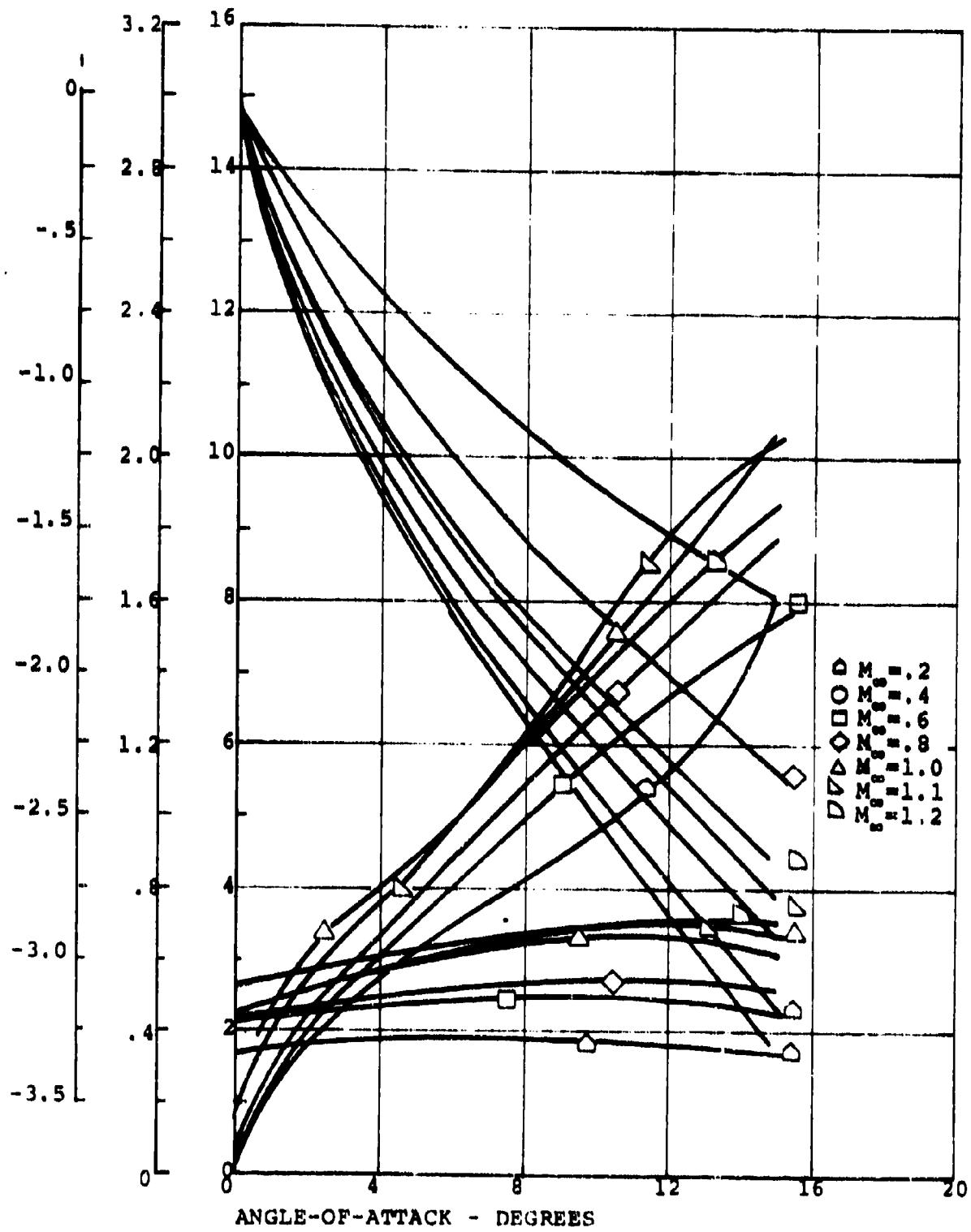
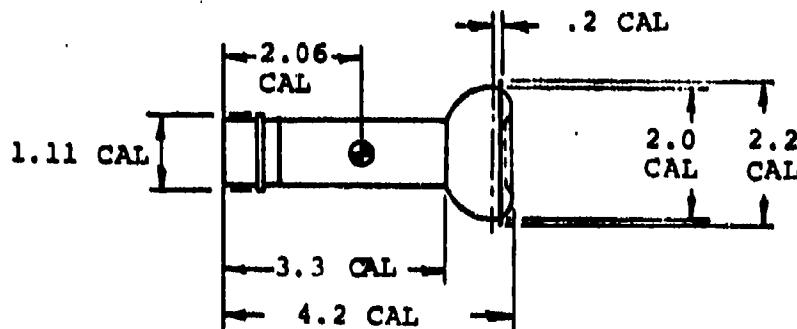


Figure 225. Graphic Static Aerodynamic Test Data: Configuration 105
(Test No. E 10)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	362
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 226. Model Specifications for Configuration 106

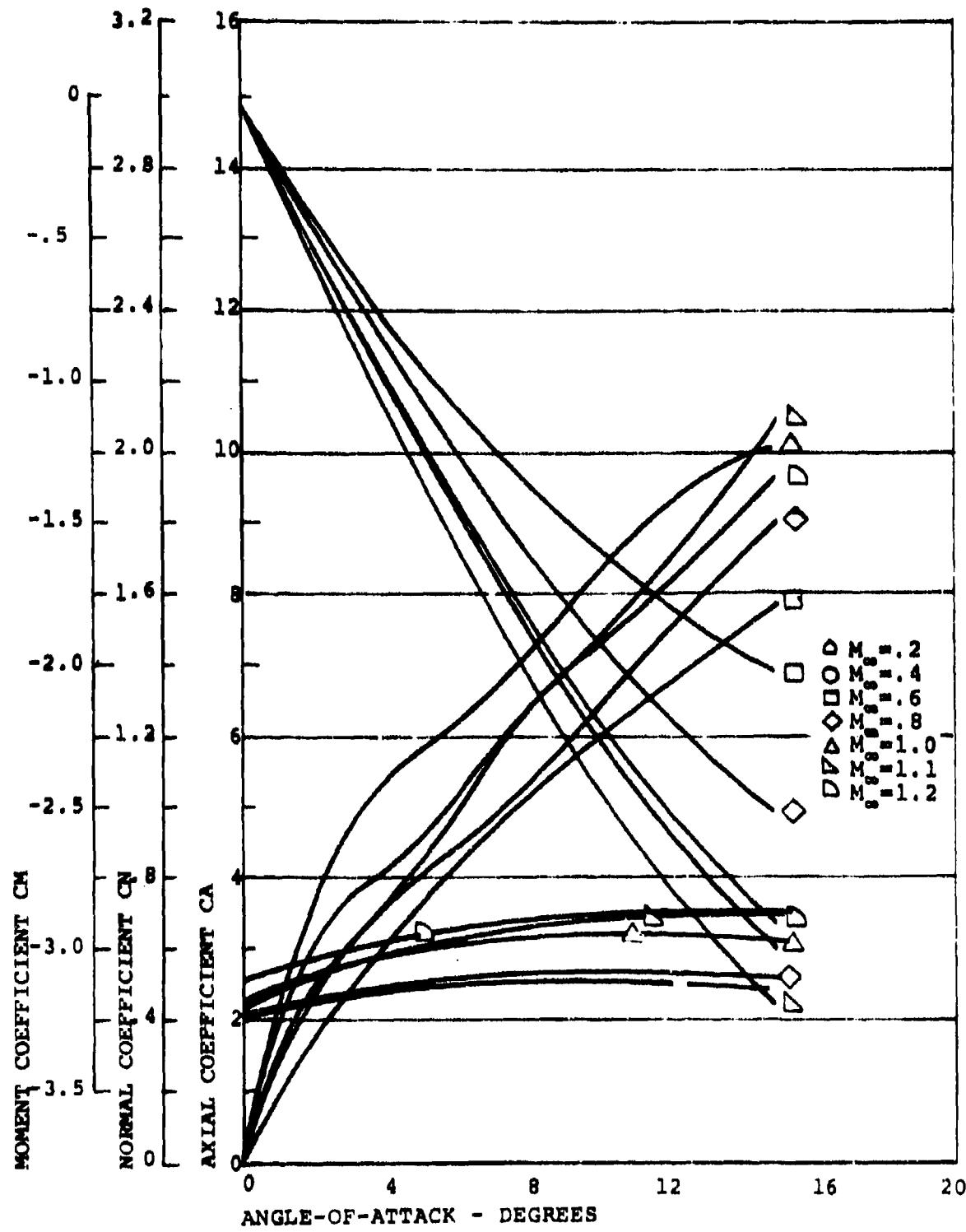
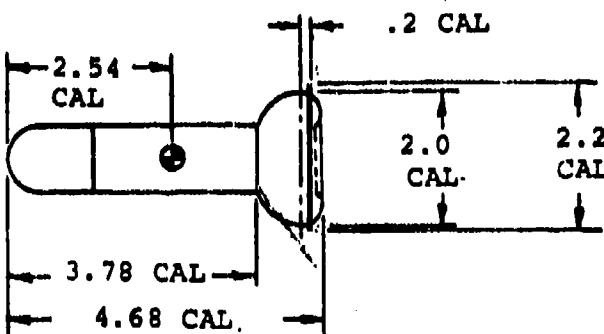


Figure 227. Graphic Static Aerodynamic Test Data:
Configuration 106 (Test No. E 11)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	364
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 228. Model Specifications for Configuration 107

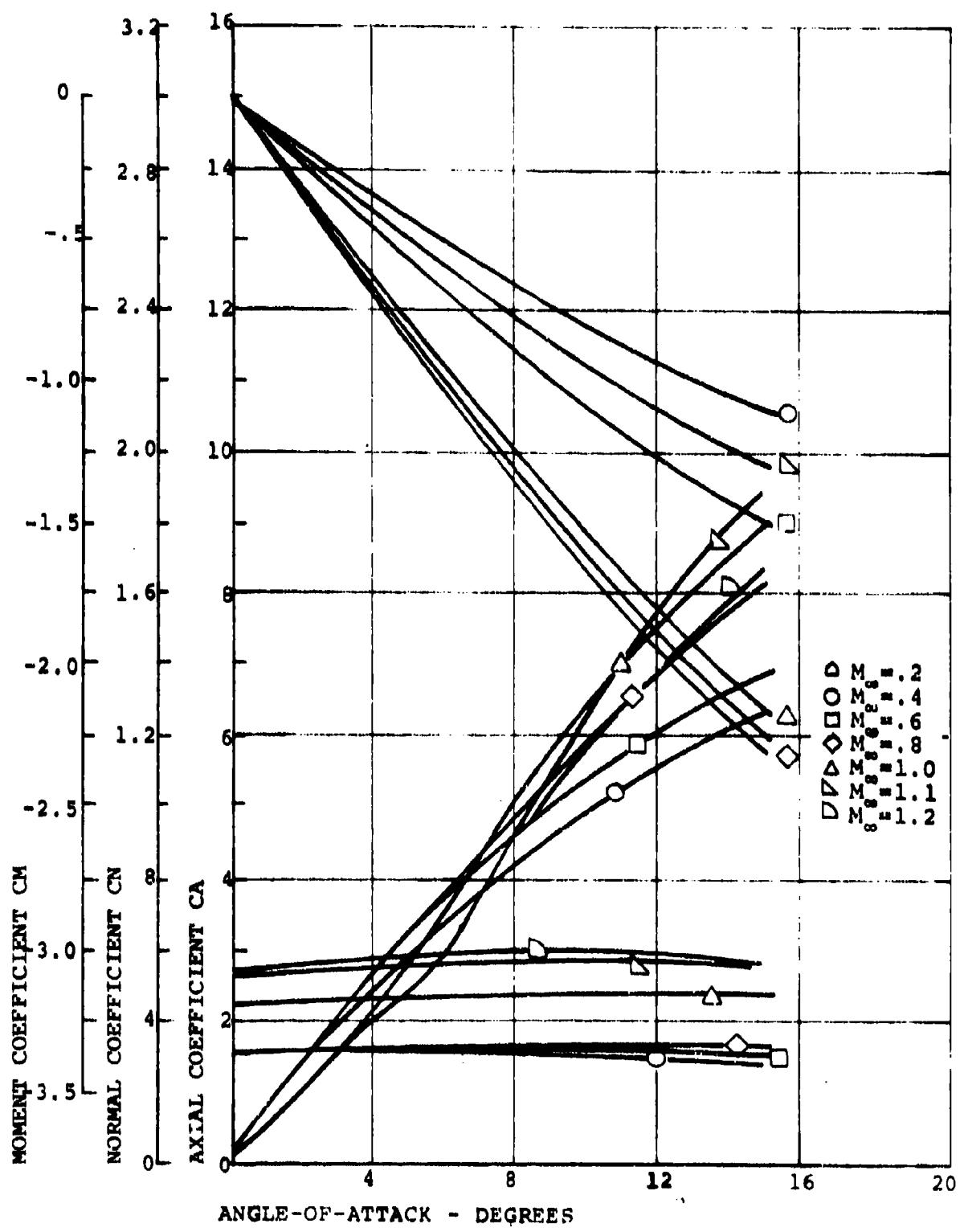
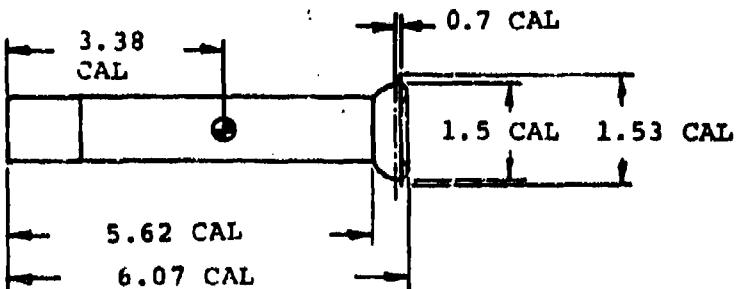


Figure 229. Graphic Static Aerodynamics Test Data:
Configuration 107 (Test No. E 12)

<u>Item</u>	<u>Page</u>
Static aerodynamic data Tabulated Plotted	366
Dynamic stability data Tabulated Plotted	



General data

Model weight = not applicable
Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
Tripper = none
Fineness ratio = 4.0 caliber
Stabilizer = see sketch
Bubble fence = see sketch
Boattail = none
Strakes (8) = none

Remarks

Figure 230. Model Specifications for Configuration 108

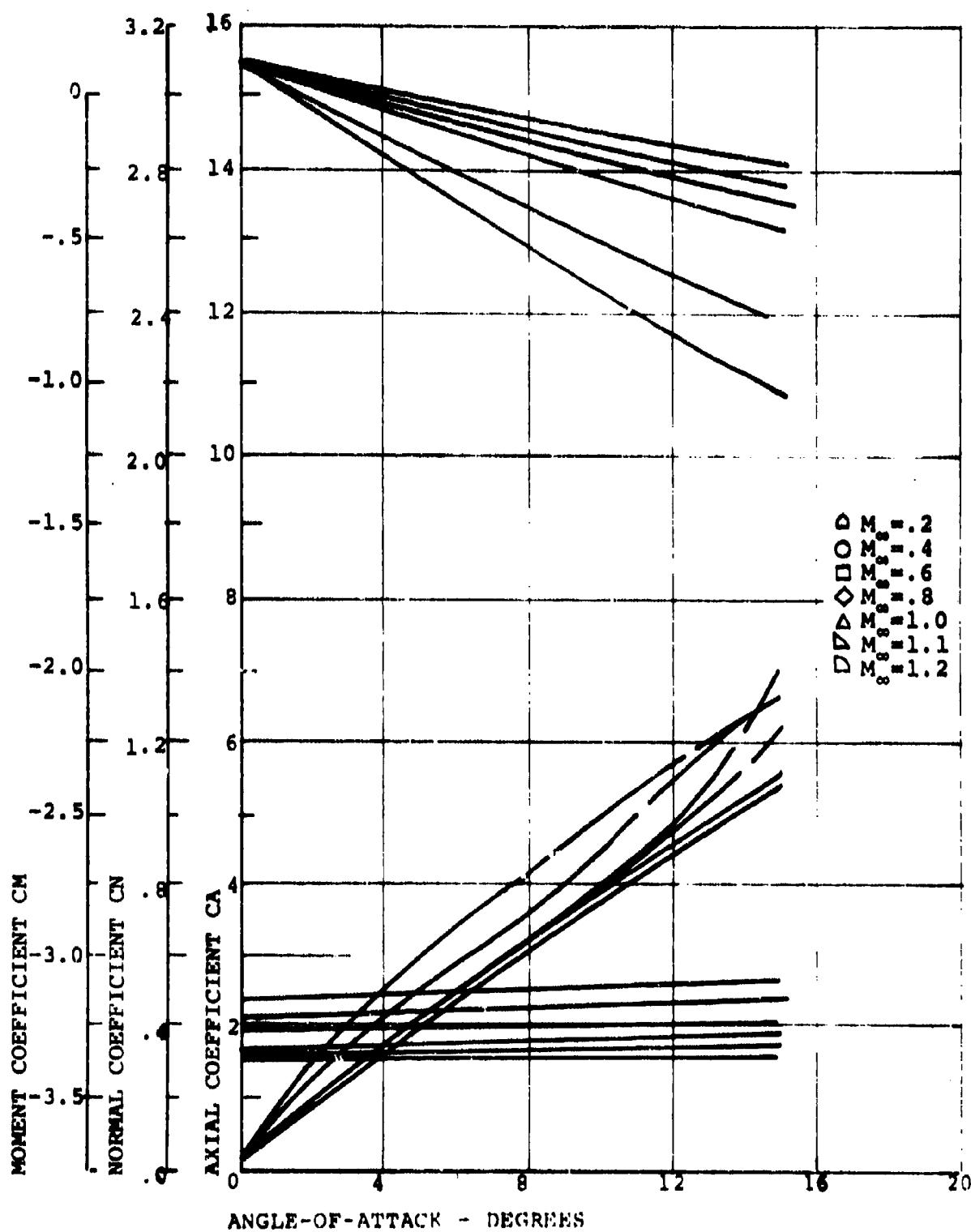
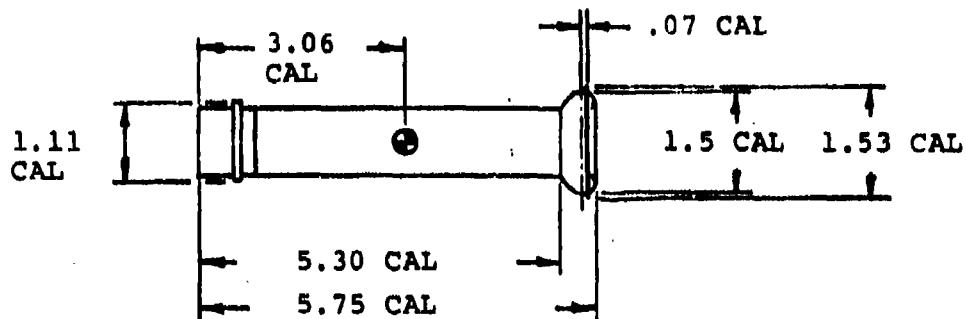


Figure 231. Graphic Static Aerodynamic Test Data:
Configuration 108 (Test No. E 13)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	368
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Burble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 232. Model Specifications for Configuration 109

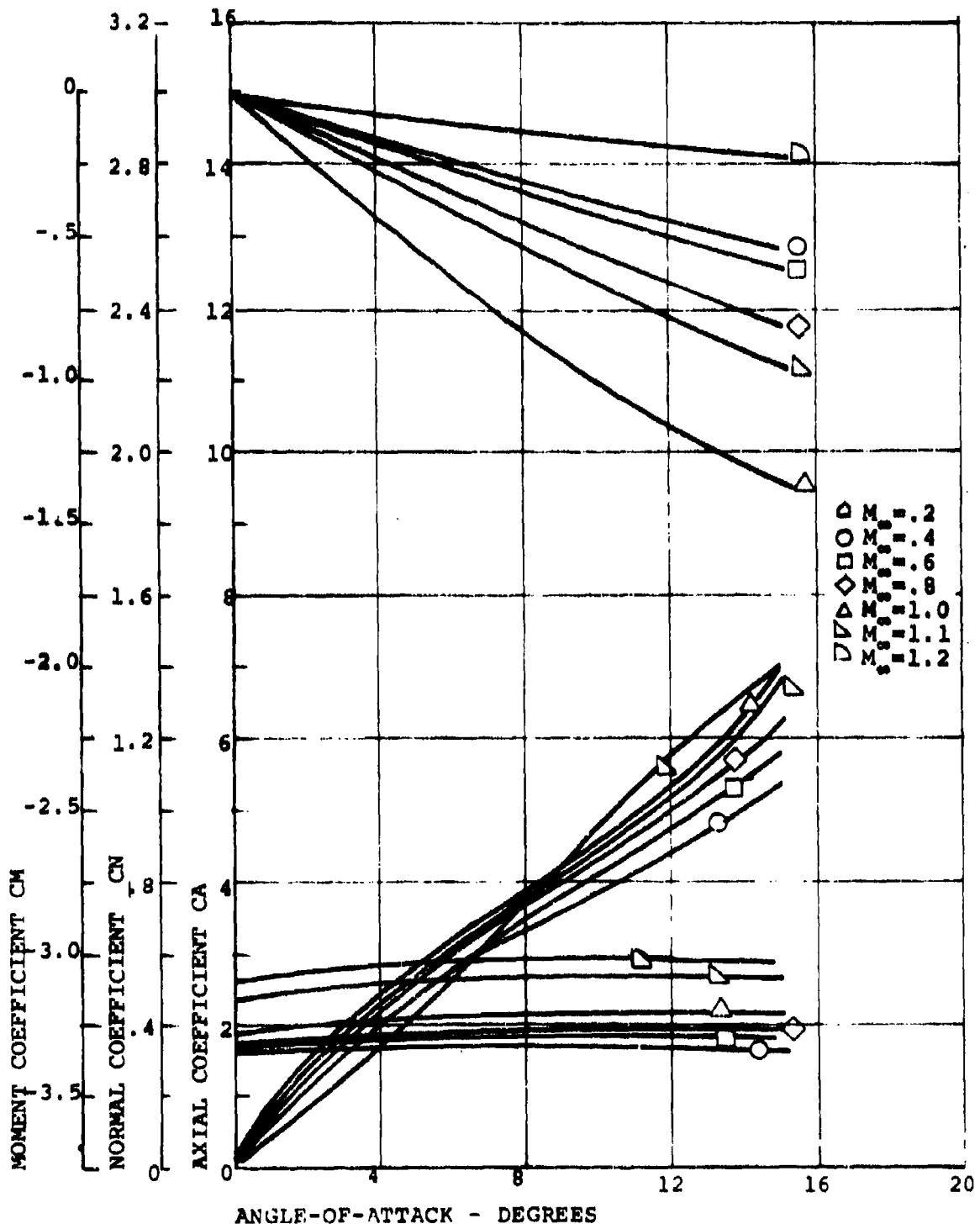
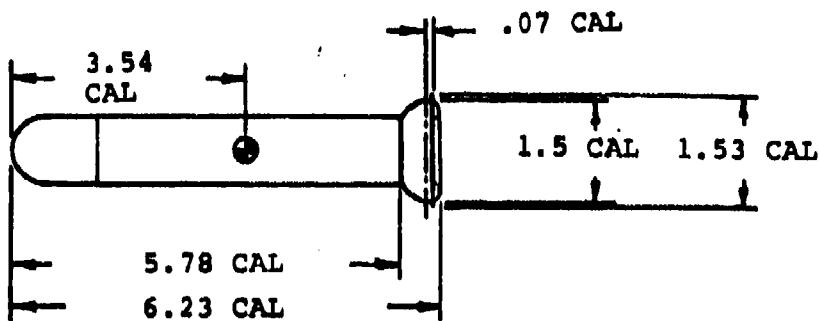


Figure 233. Graphic Static Aerodynamic Test Data:
Configuration 109 (Test No. E 14)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	370
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Burble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 234. Model Specifications for Configuration 110

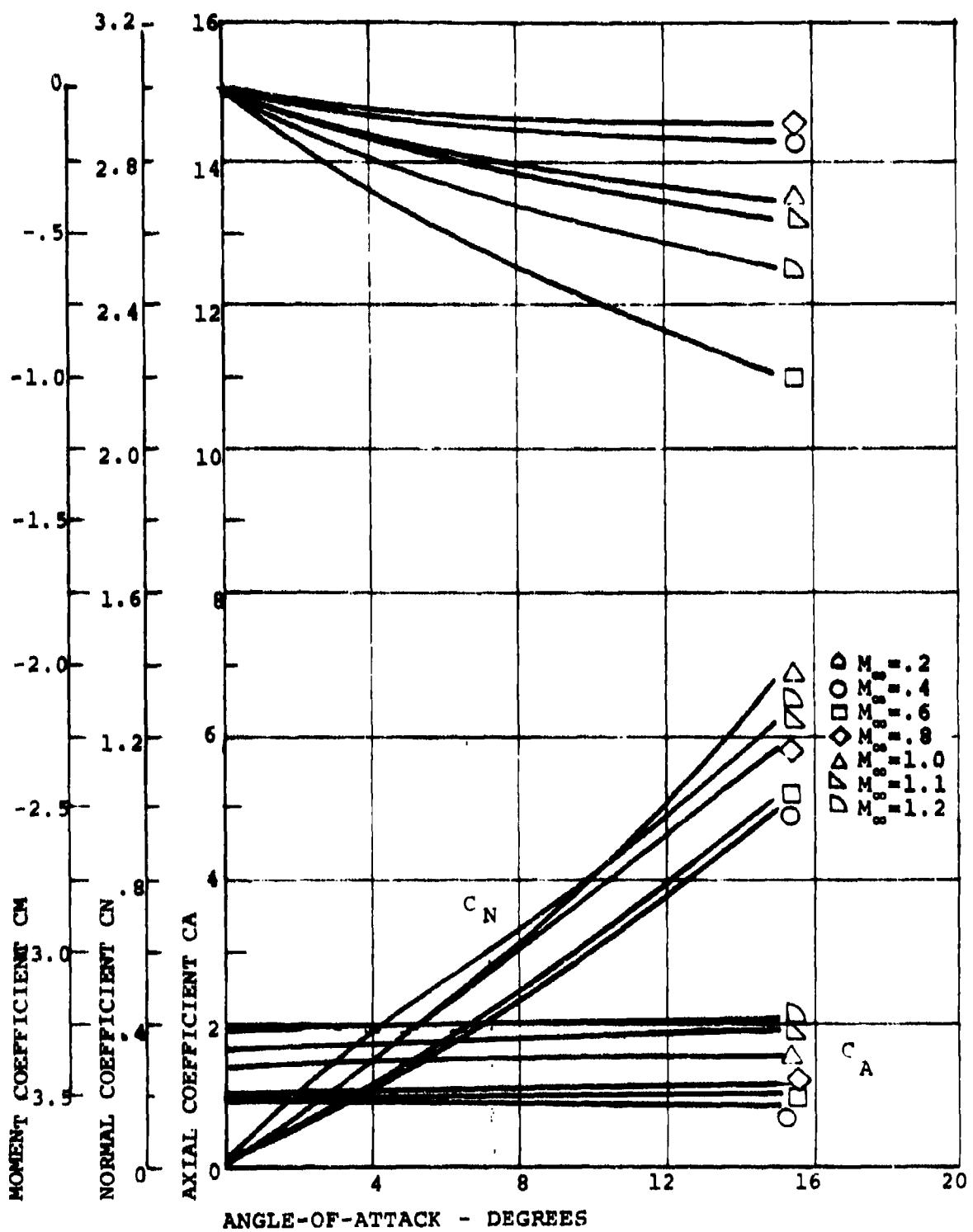
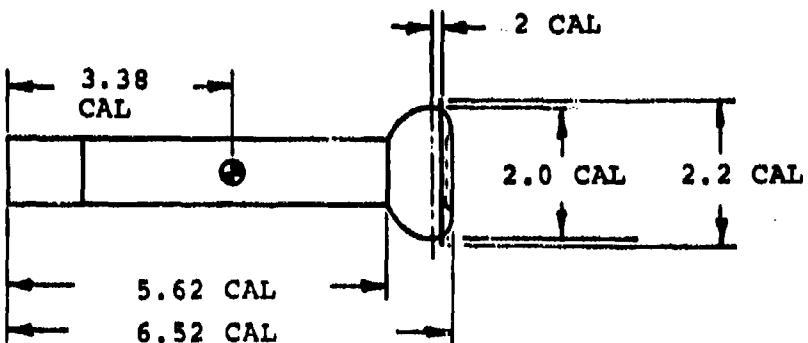


Figure 235. Graphic Static Aerodynamic Test Data:
Configuration 110 (Test No. E 15)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	372
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 236. Model Specifications for Configuration 111

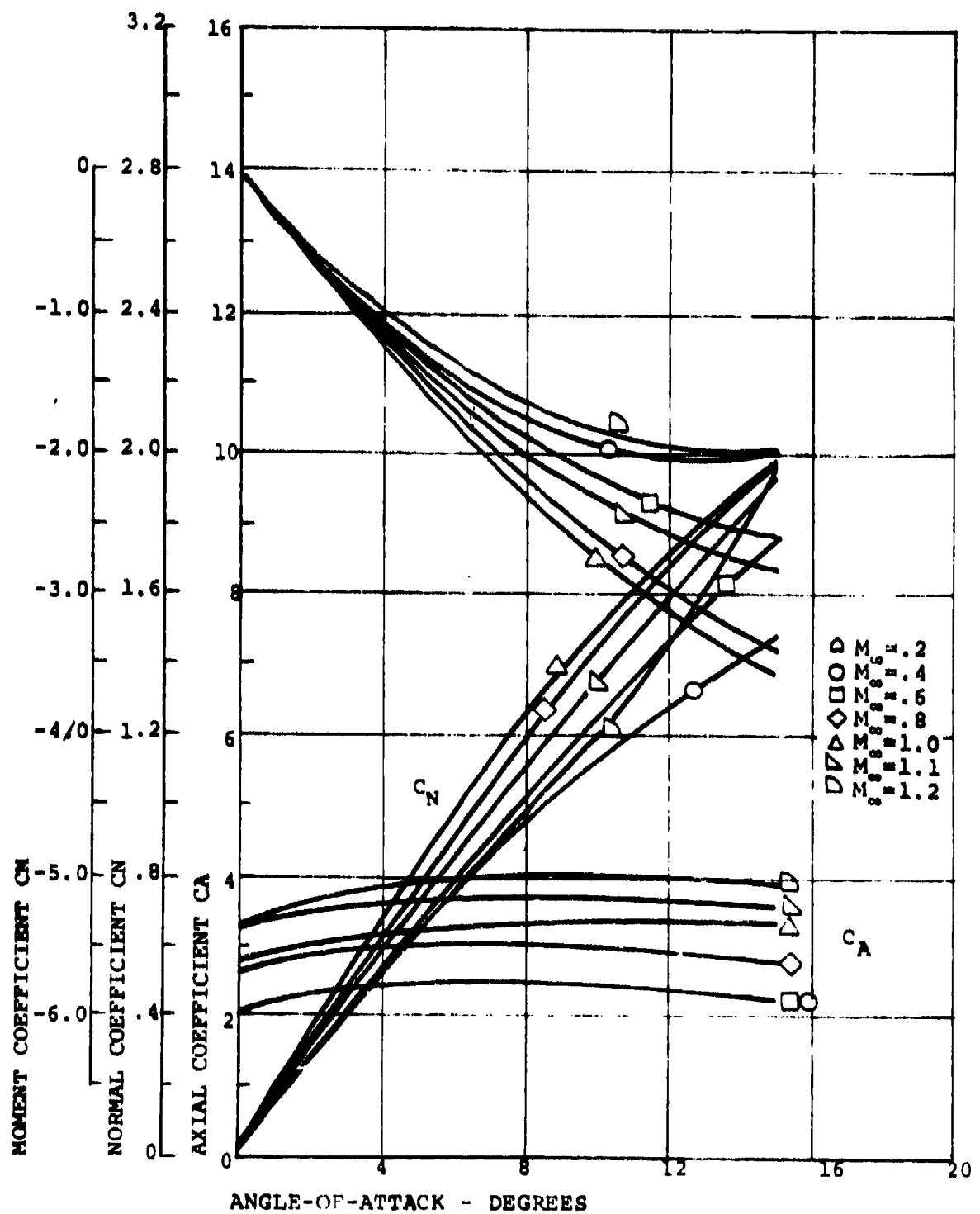
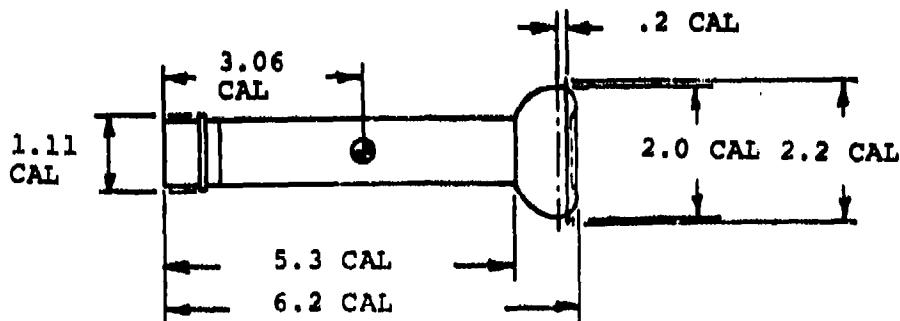


Figure 237. Graphic Static Aerodynamic Test Data:
Configuration III (Test No E 16)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	374
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape	= 1.0 caliber ogive
Tripper	= none
Fineness ratio	= 4.0 caliber
Stabilizer	= see sketch
Bubble fence	= see sketch
Boattail	= none
Strakes (8)	= none

Remarks

Figure 238. Model Specifications for Configuration 112

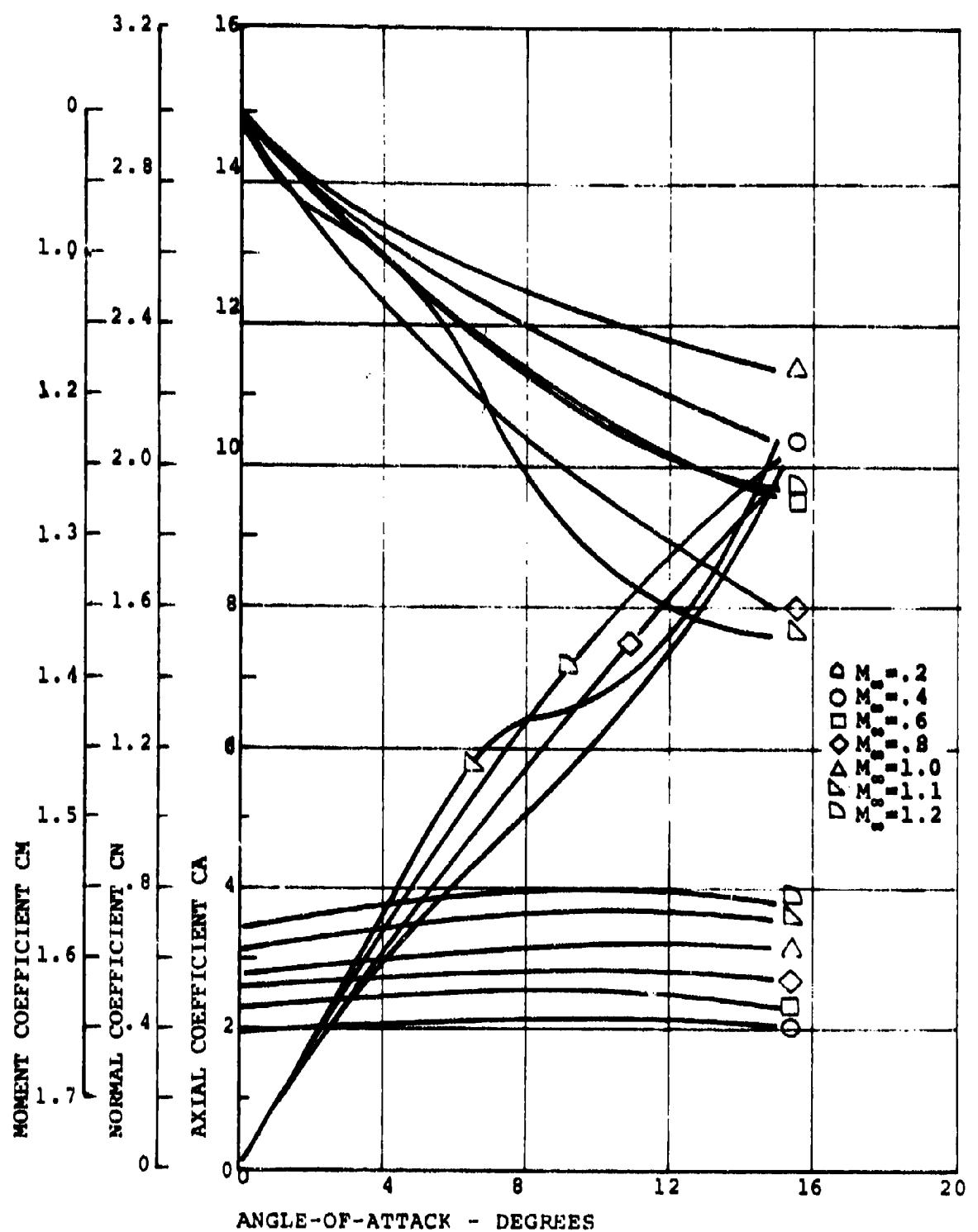
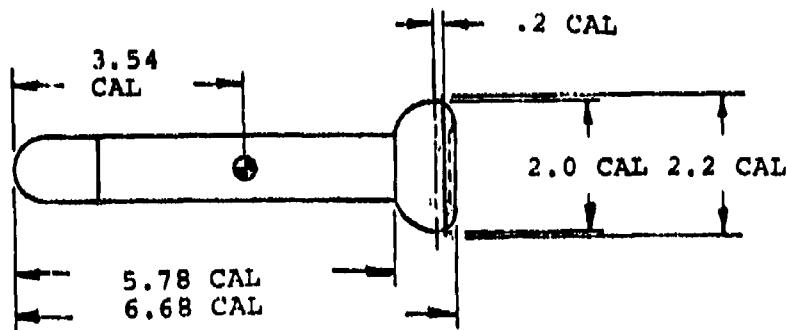


Figure 239. Graphic Static Aerodynamic Test Data:
Configuration 112 (Test No. E 17)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	376
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 240. Model Specifications for Configuration 113

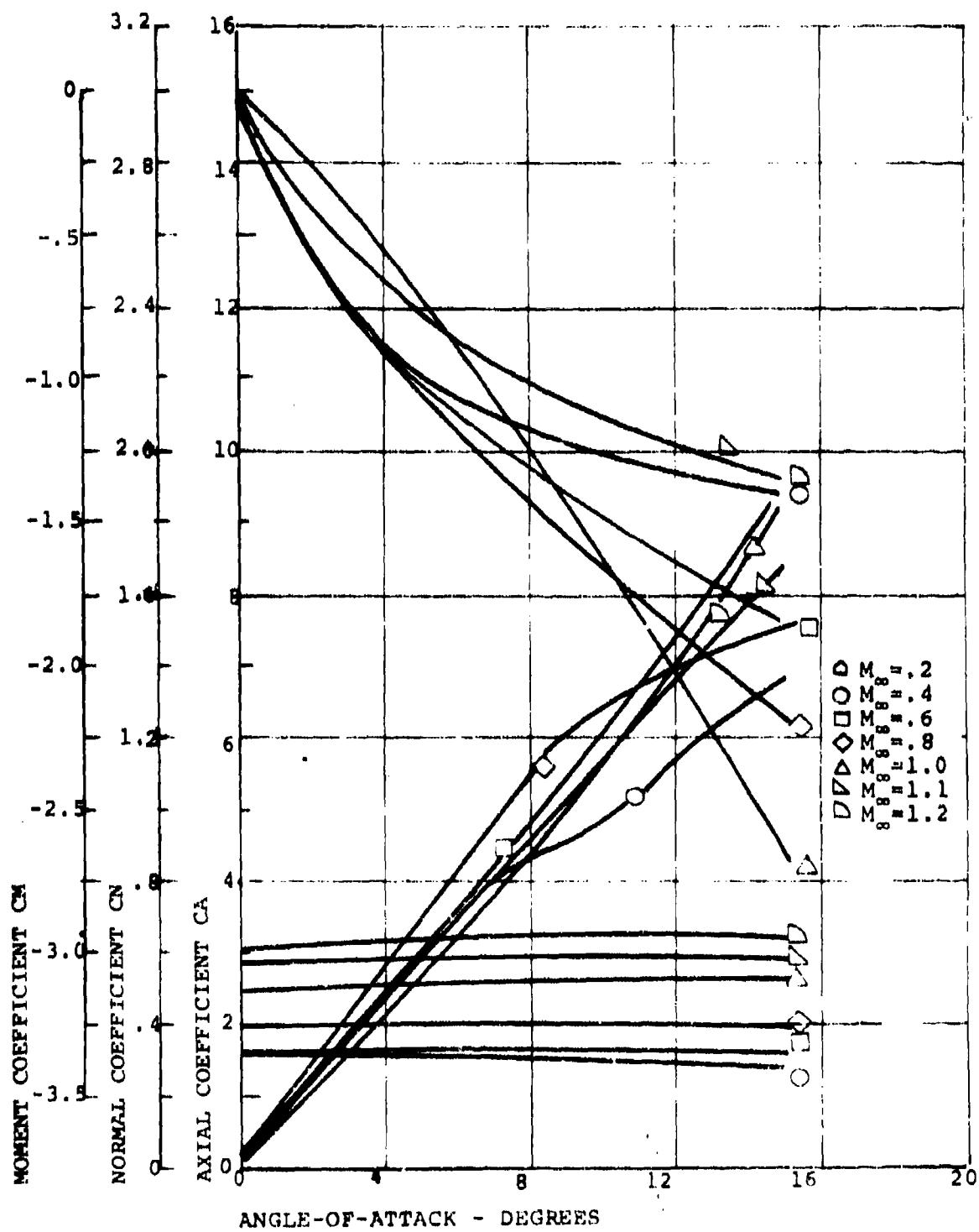
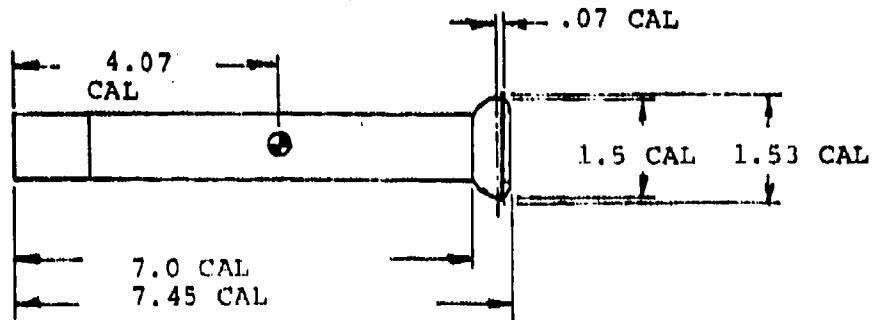


Figure 241. Graphic Static Aerodynamic Test Data:
Configuration 113 (Test No. E 18)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	378
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

*Copy available to DDC does not
 permit fully legible reproduction*

Remarks

Figure 242. Model Specifications for Configuration 114

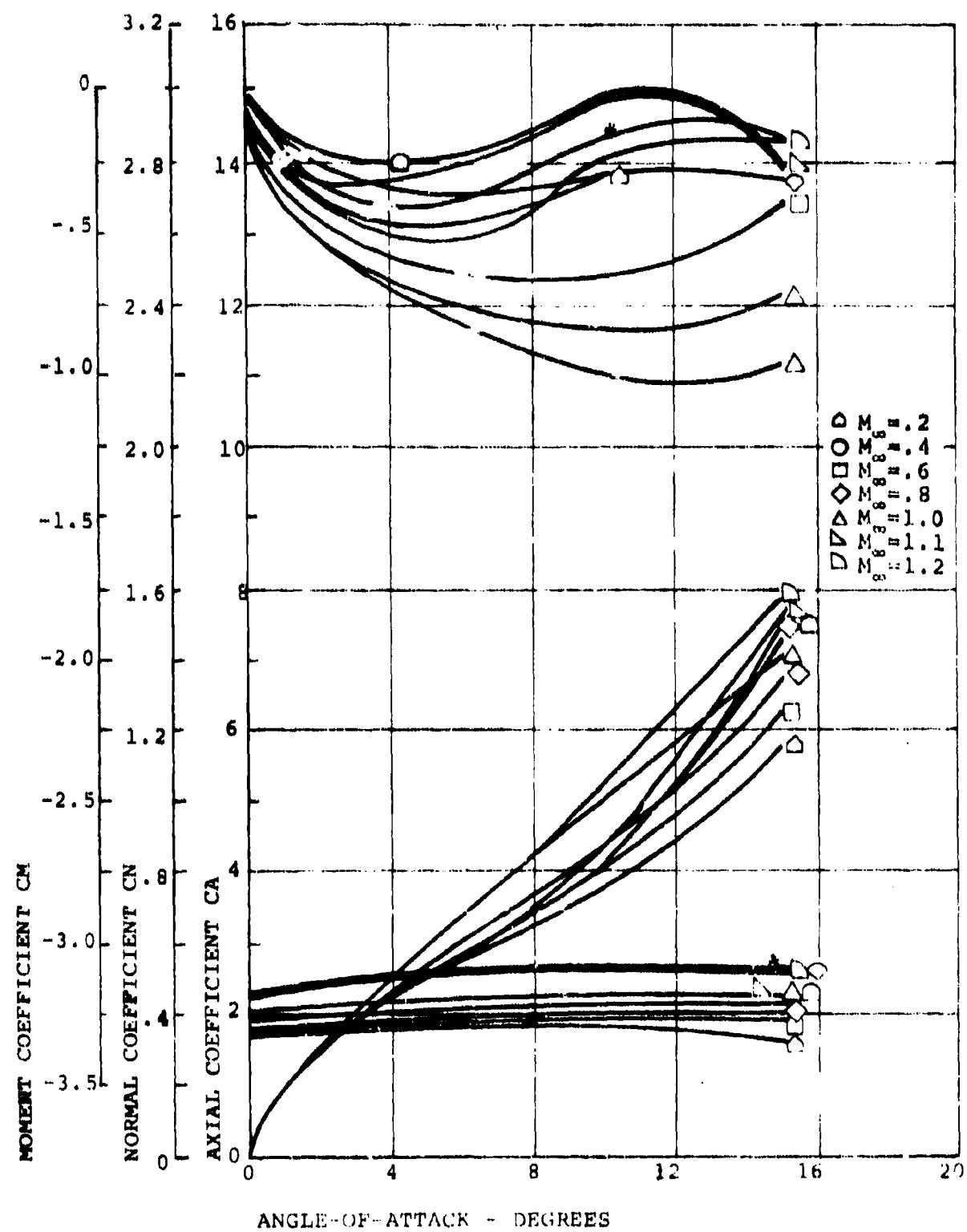
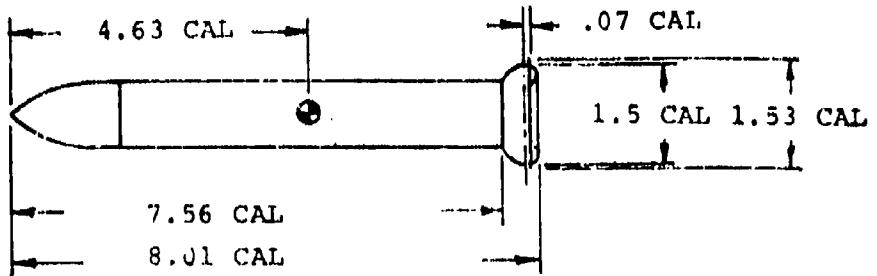


Figure 243. Graphic Static Aerodynamic Test Data:
Configuration 114 (Test No. E 19)

Item	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	380
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Burble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 244. Model Specification for Configuration 115

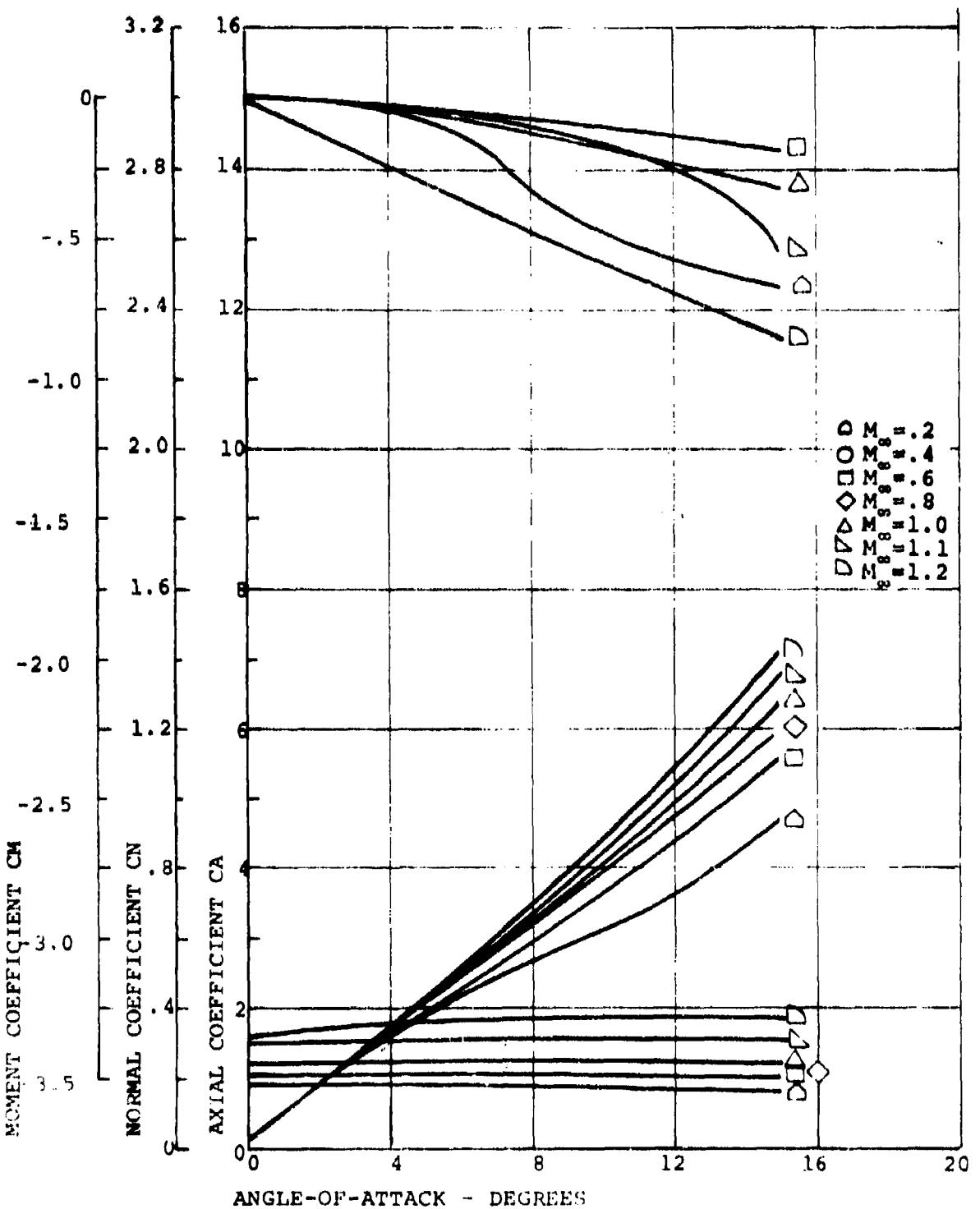
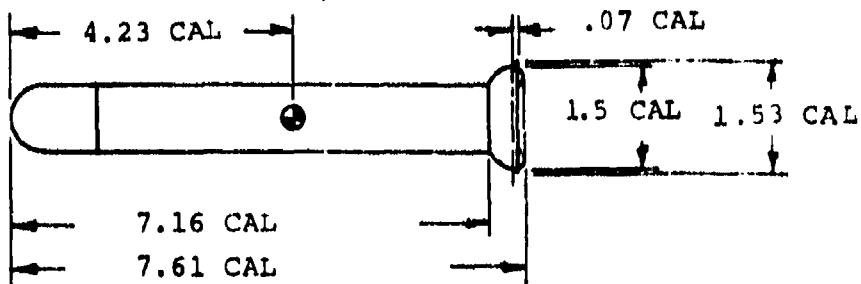


Figure 245. Graphic Static Aerodynamic Test Data:
Configuration 115 (Test No. E 20)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	382
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 246. Model Specification for Configuration 116

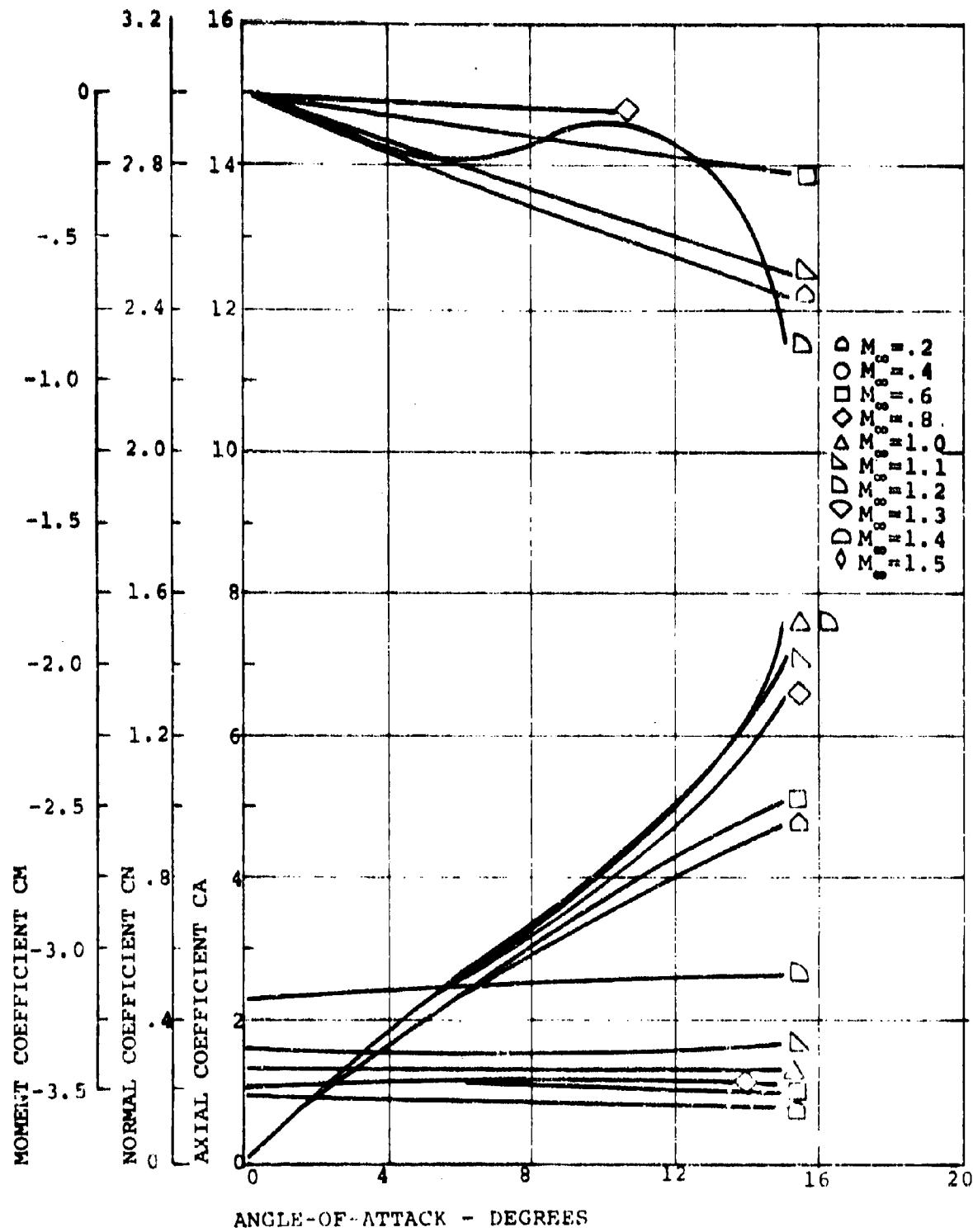
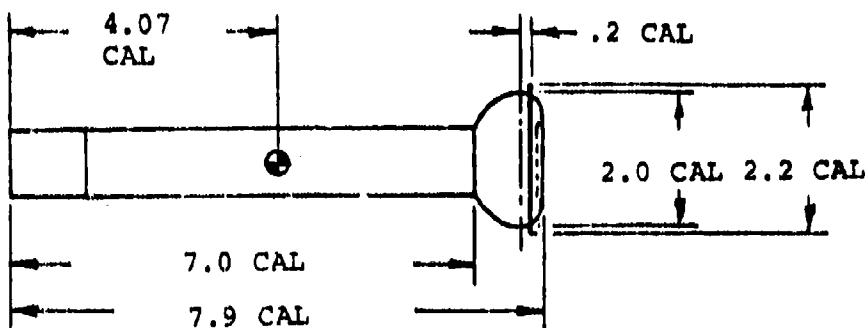


Figure 247. Graphic Static Aerodynamic Test Data:
Configuration 116 (Test No. E 21)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	384
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tipper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 248. Model Specification for Configuration 117

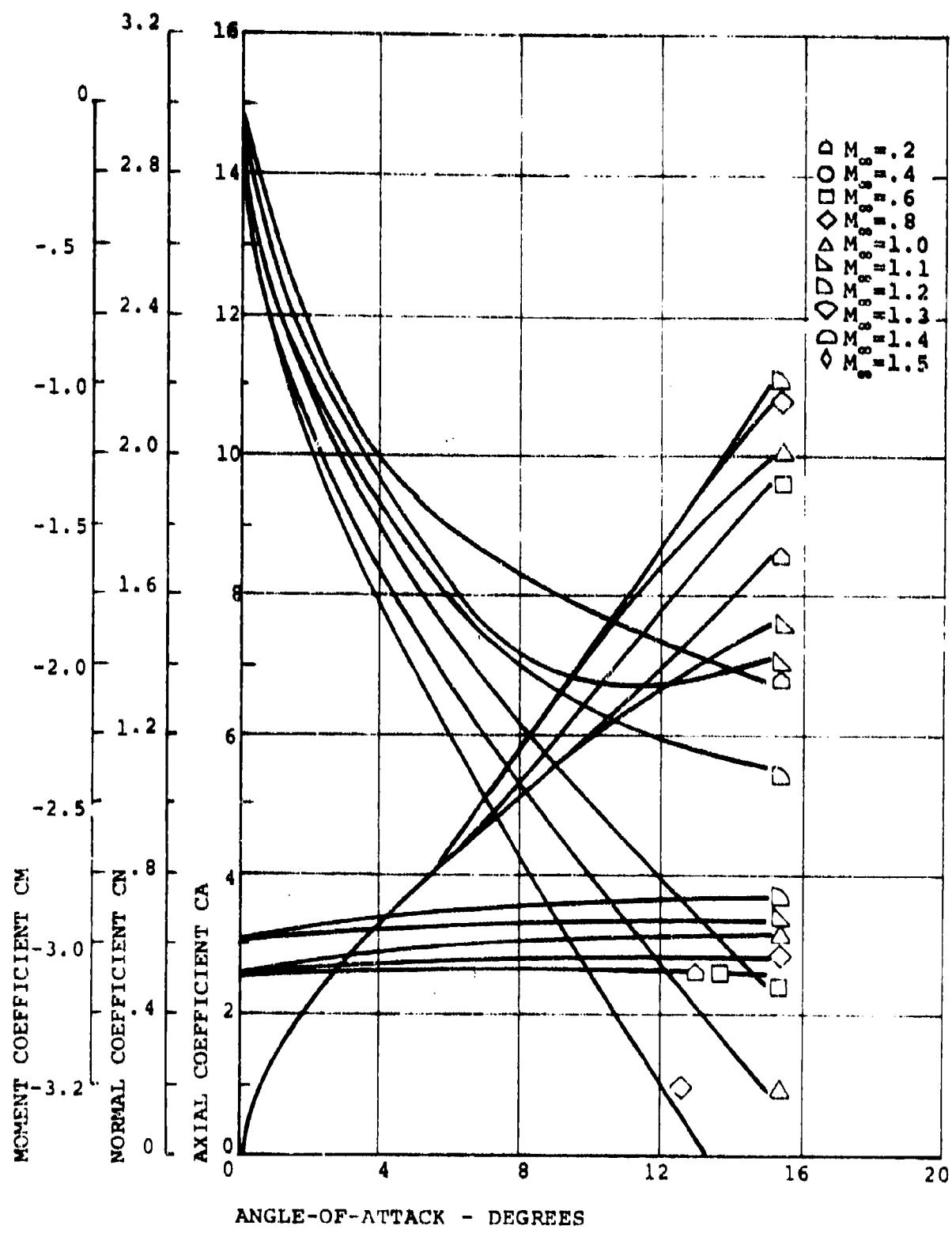
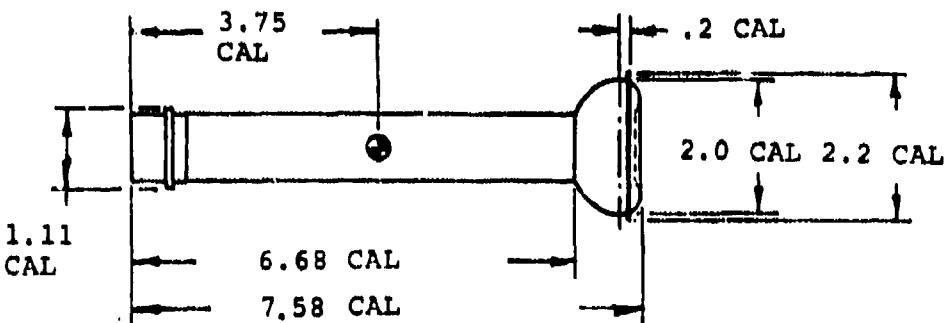


Figure 249. Graphic Static Aerodynamic Test Data:
Configuration 117 (Test No. E 22)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	386
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Copy available to DDC does not permit fully legible reproduction

Remarks

Figure 250. Model Specifications for Configuration 118

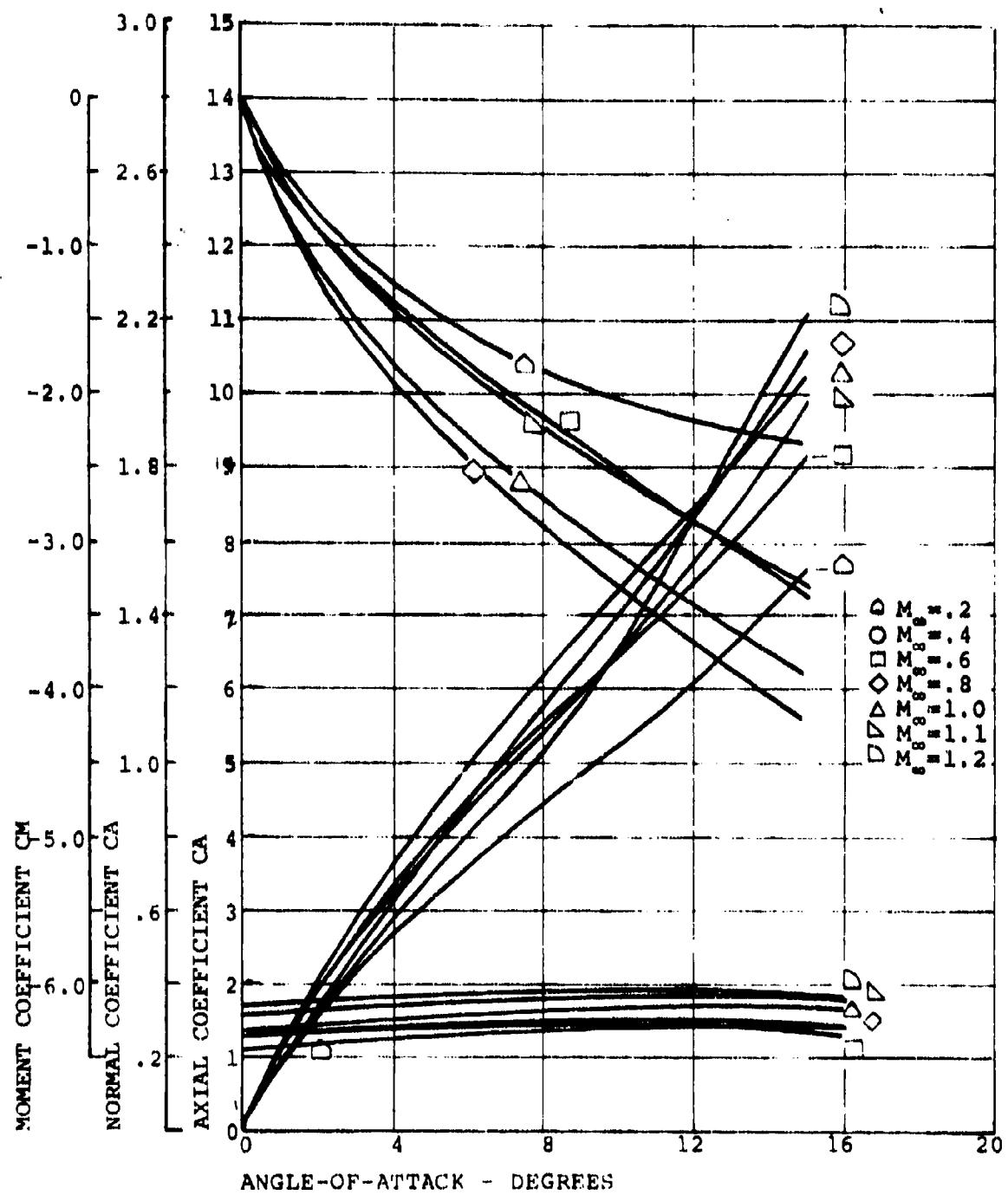
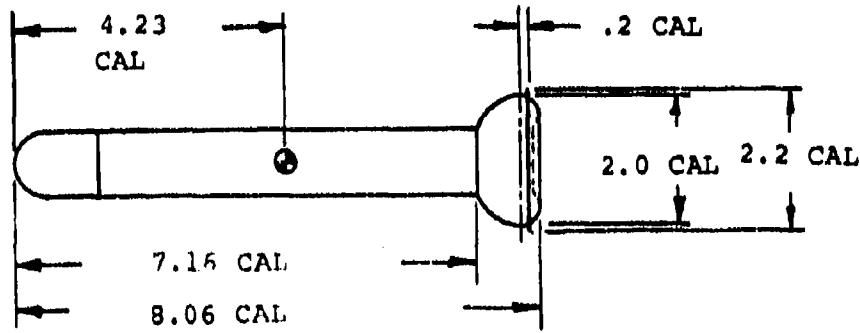


Figure 251. Graphic Static Aerodynamic Test Data:
Configuration 118 (Test No. E 23)

<u>Item</u>	<u>Page</u>
Static aerodynamic data	
Tabulated	
Plotted	388
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
 Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
 Tripper = none
 Fineness ratio = 4.0 caliber
 Stabilizer = see sketch
 Bubble fence = see sketch
 Boattail = none
 Strakes (8) = none

Remarks

Figure 252. Model Specification for Configuration 119

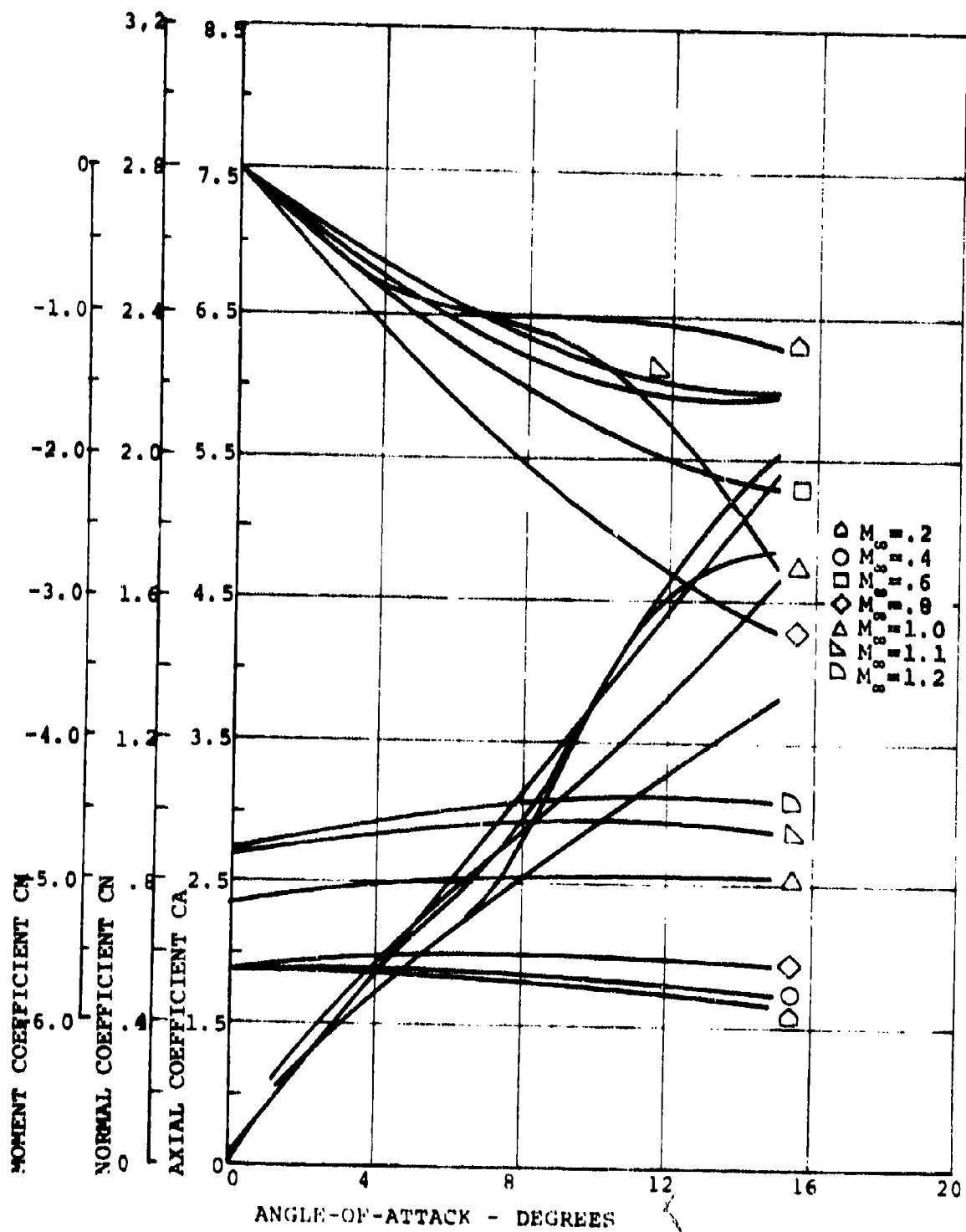


Figure 263. Graphic Static Aerodynamic Test Data:
Configuration 119 (Test No. E 24)

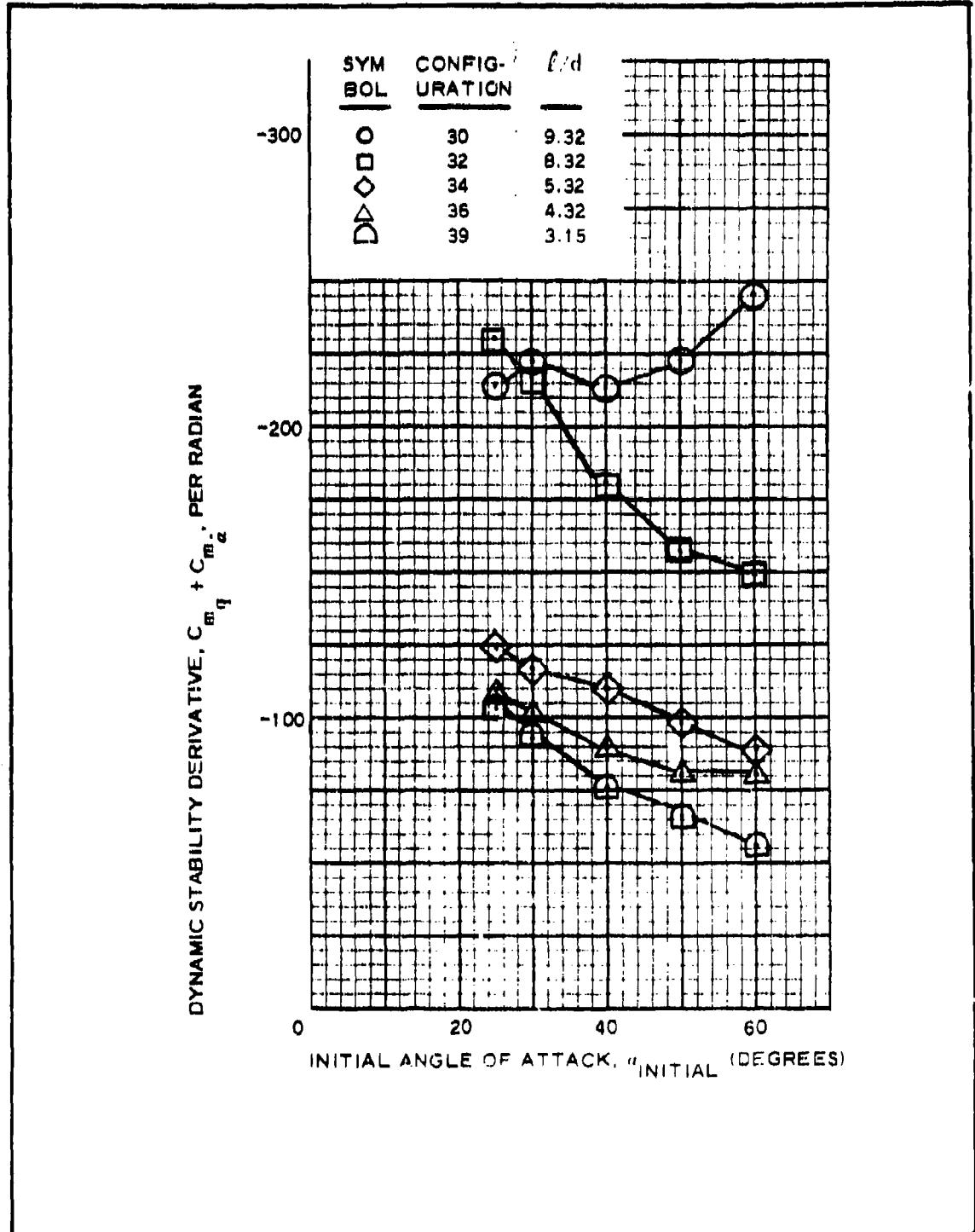


Figure 254. Effect of fineness Ratio on Dynamic Stability of Ballute Stabilized Bomb: 1-1/2-Caliber Ballute, $V = 100$ Feet per Second

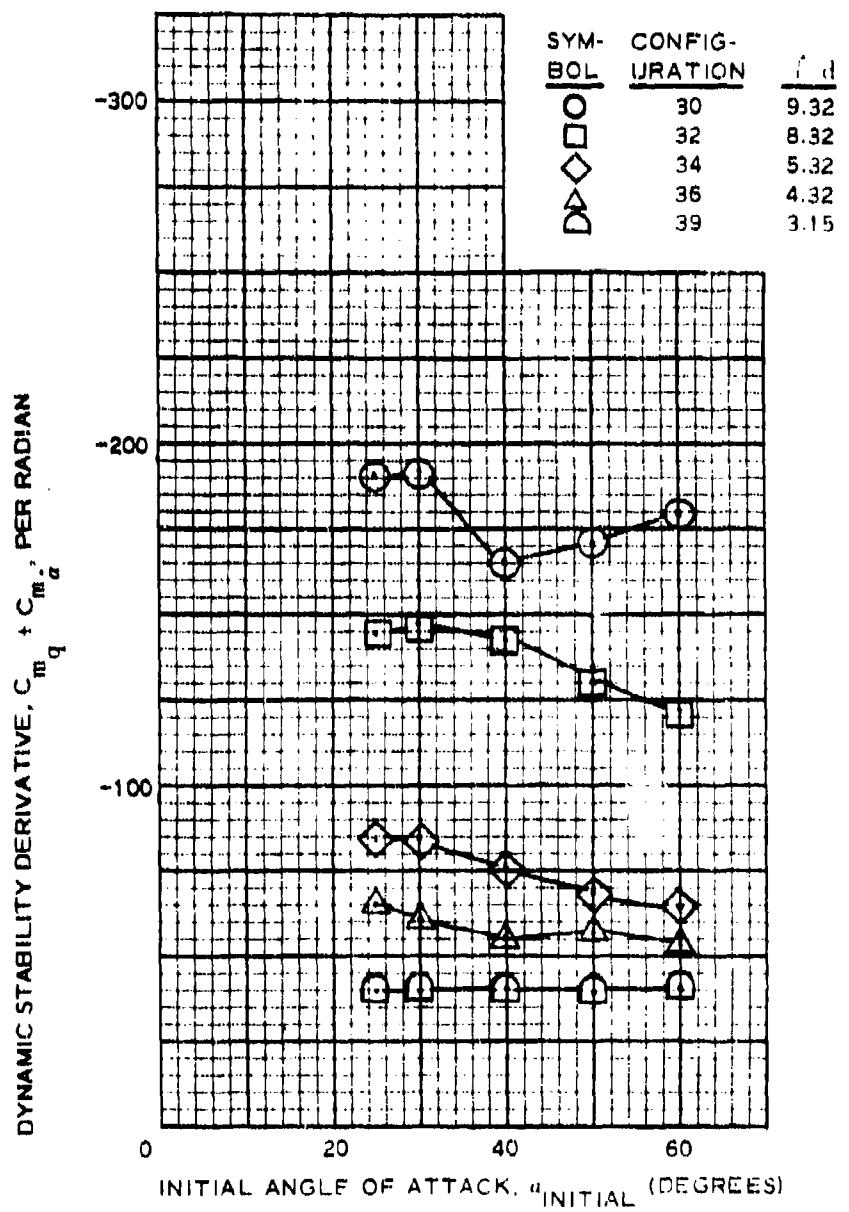


Figure 255. Effect of Fineness Ratio on Dynamic Stability of Ballute Stabilized Bomb: 1-1/2-Caliber Ballute, $V = 200$ Feet per Second

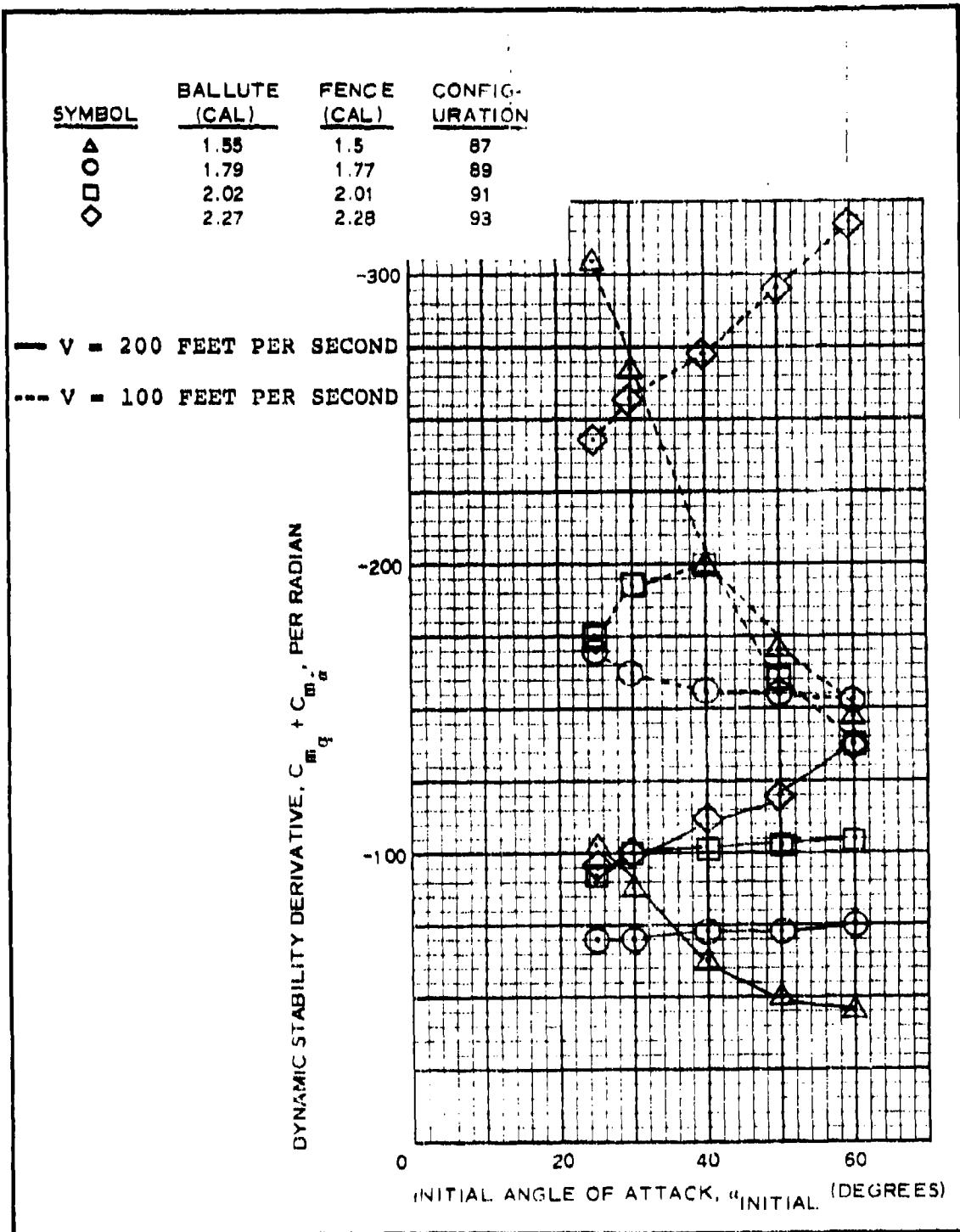


Figure 256. Effect Ballute Size on Dynamic Stability of 3.0-Caliber Bomb

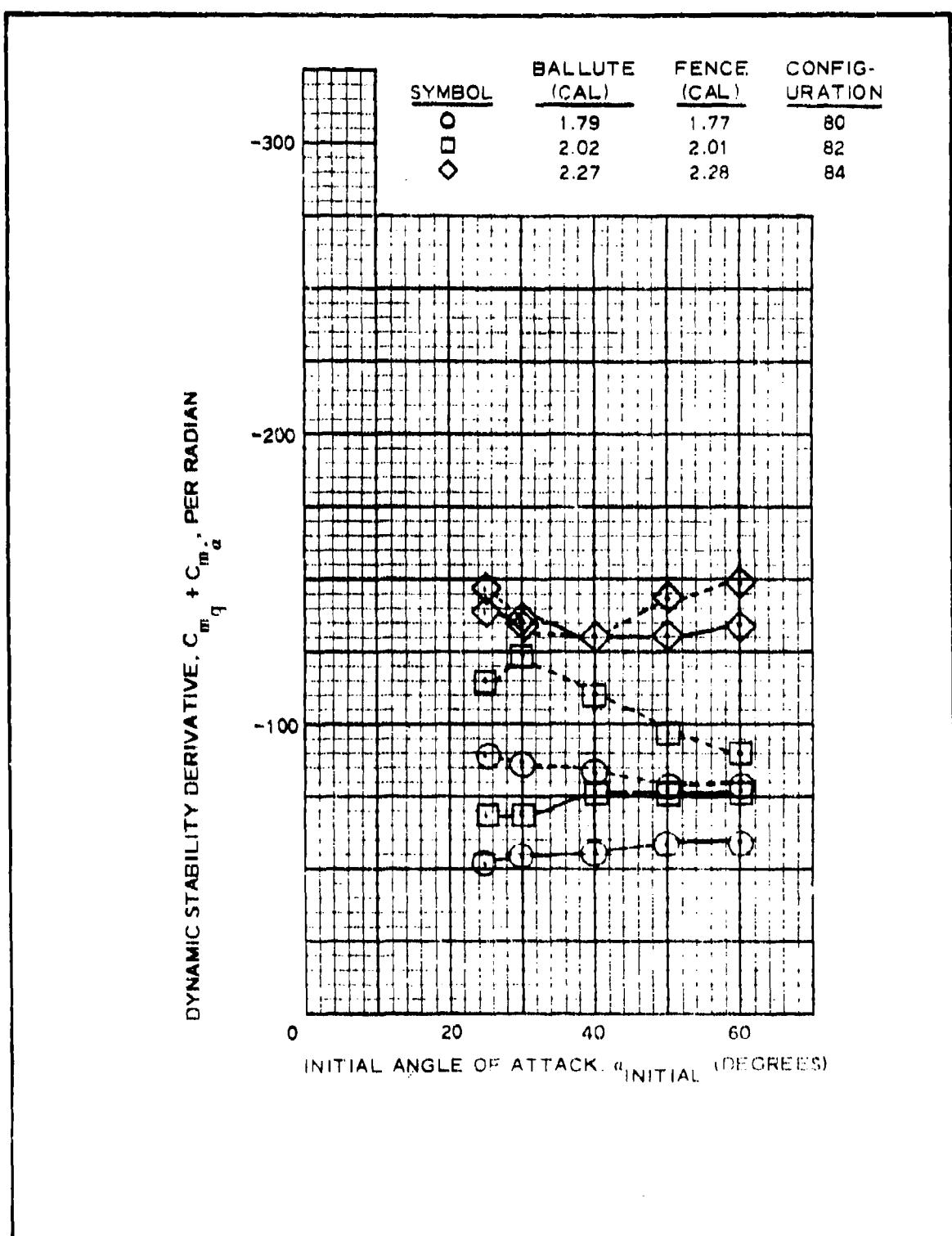


Figure 257. Effect of Ballute Size on Dynamic Stability of 5.0-Caliber Bomb

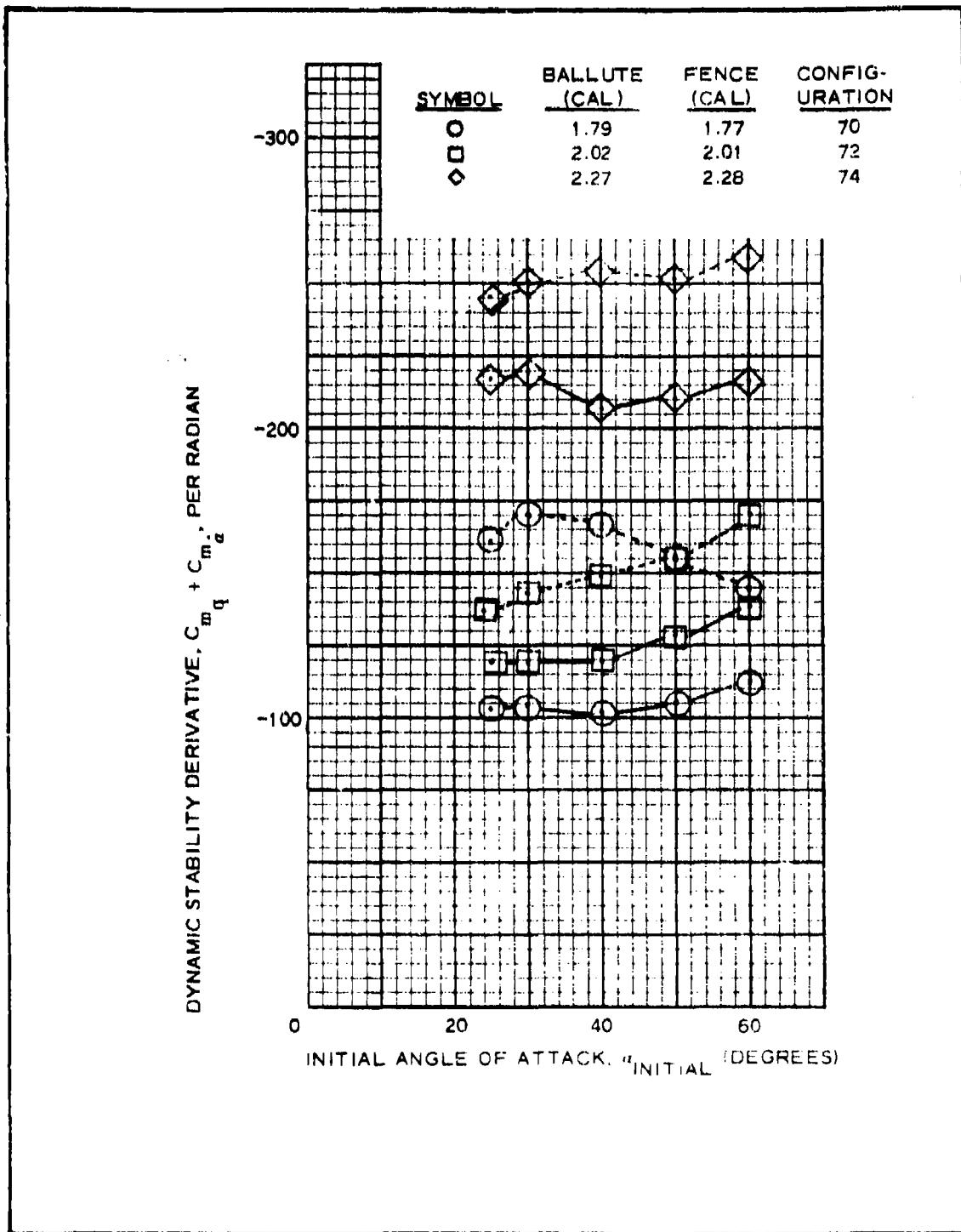


Figure 258. Effect of Ballute Size on Dynamic Stability of 7.0-Caliber Bomb

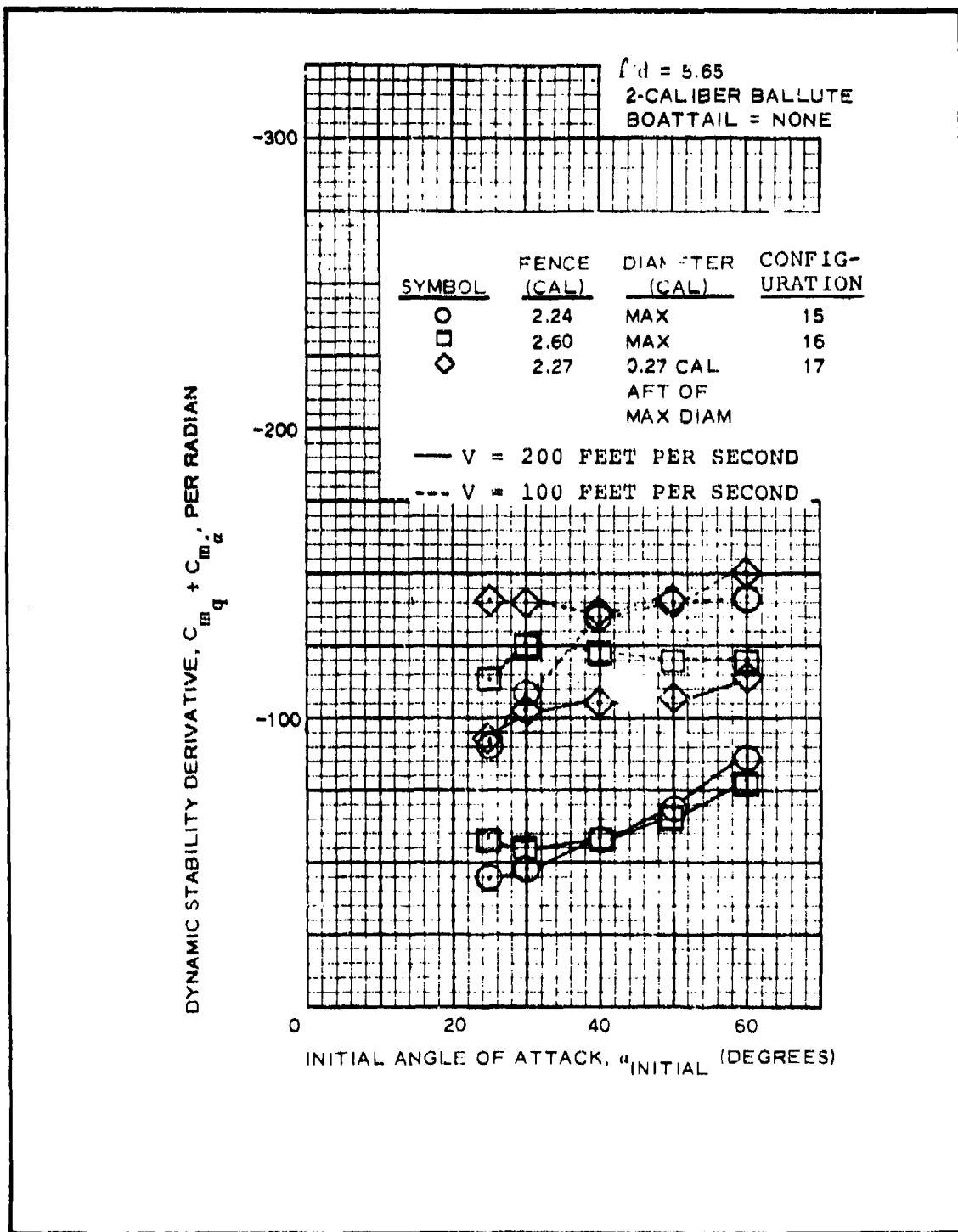


Figure 259. Effect of Ballute Bubble Fence Variables on Dynamic Stability of 5.65-Caliber Bomb

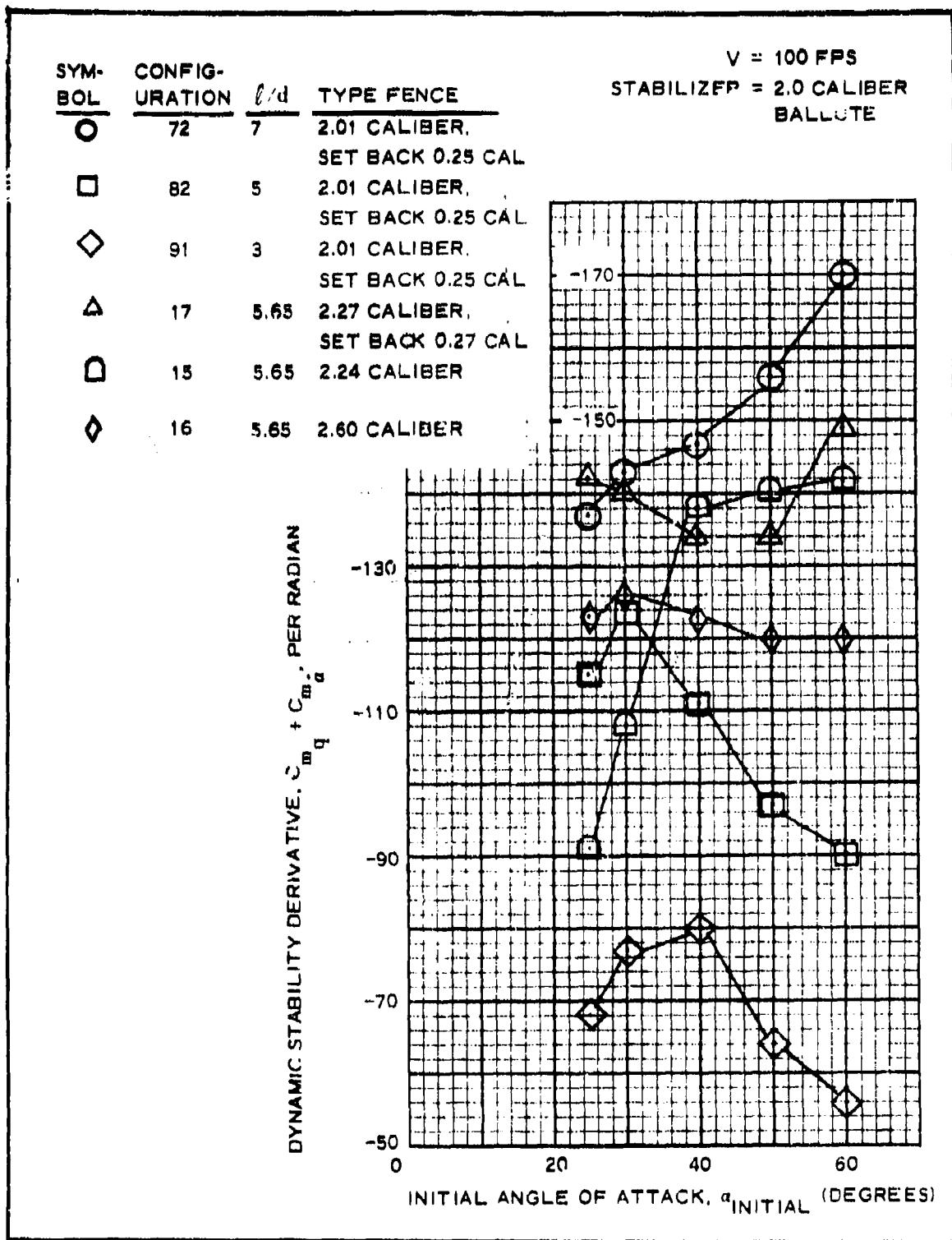


Figure 260. Combined Effects of Fineness Ratio and Burble Fence on Dynamic Stability: $V = 100 \text{ FPS}$, Stabilizer = 2.0-Caliber Ballute

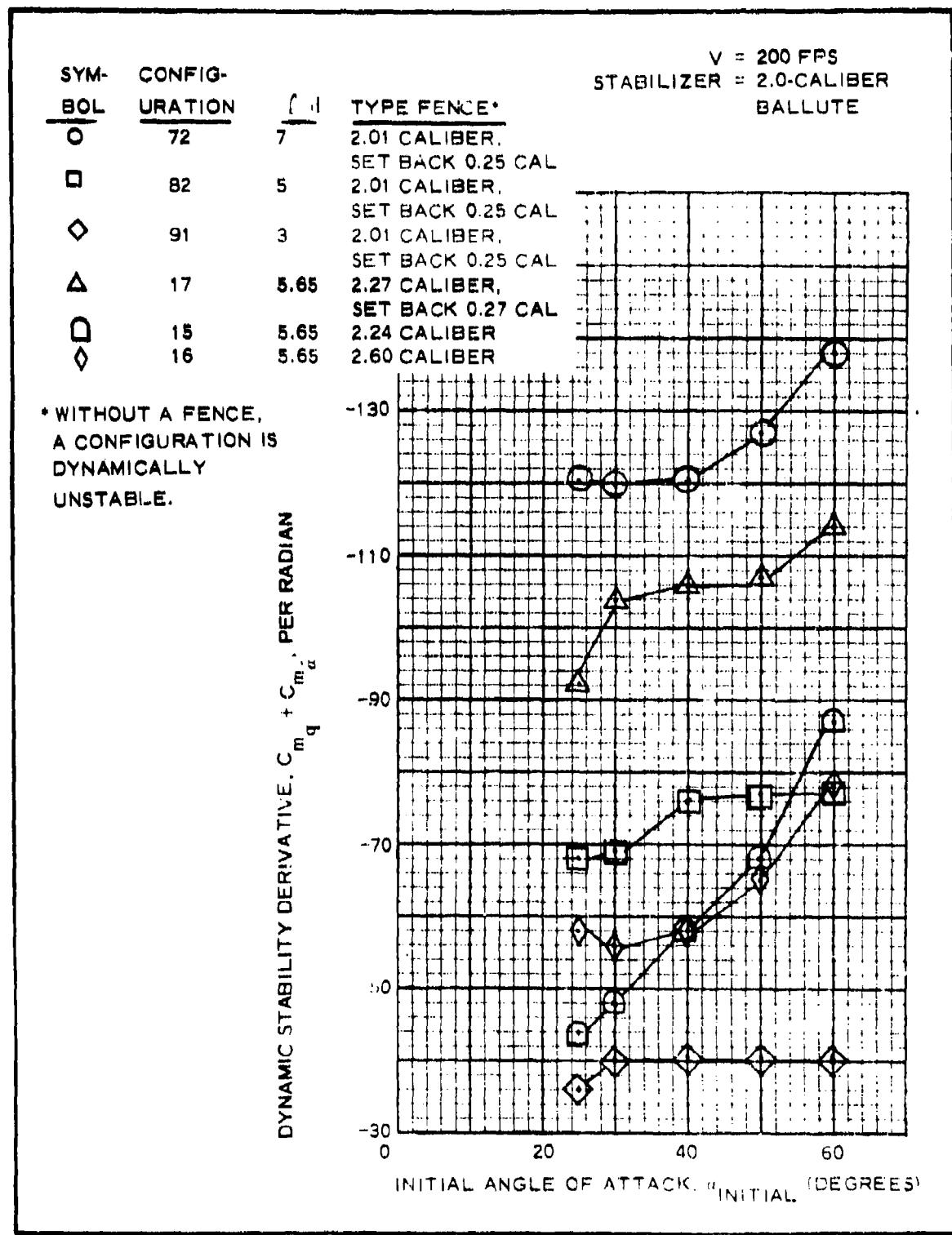
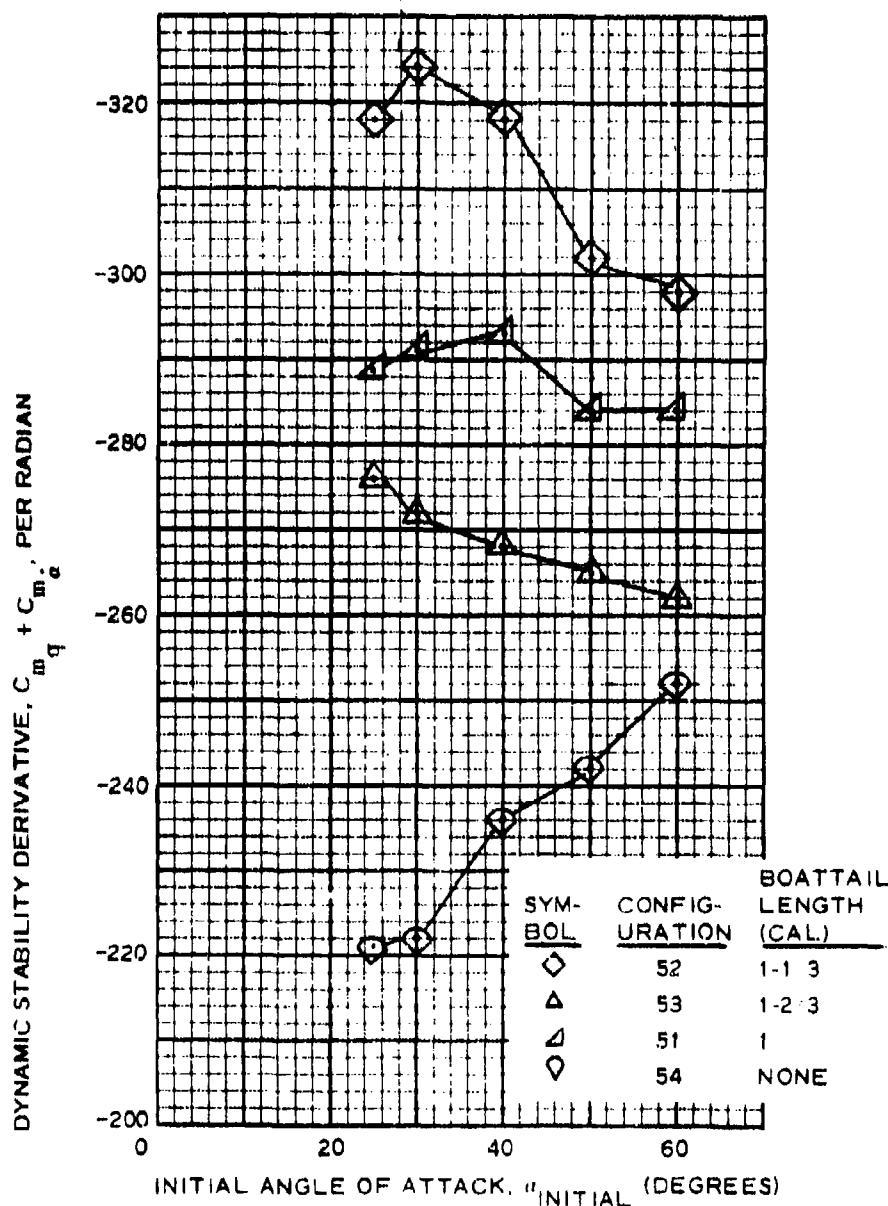
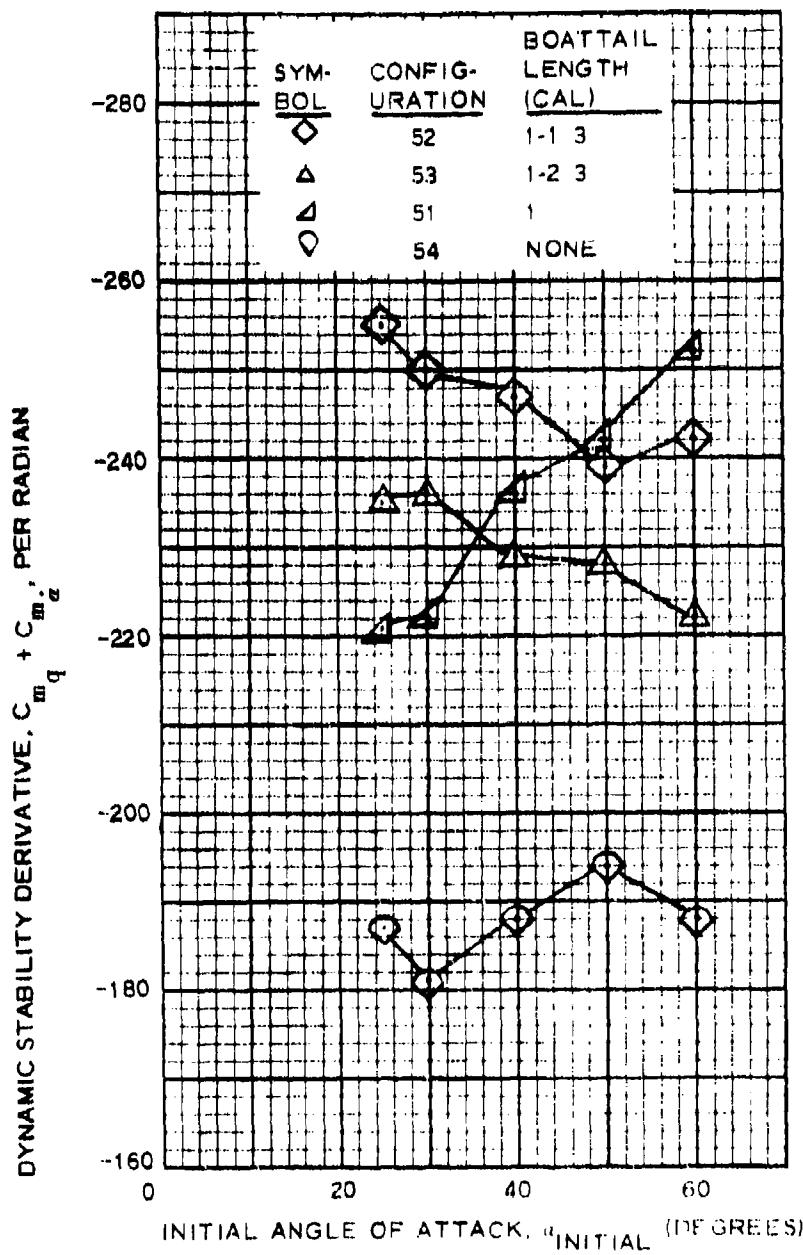


Figure 261. Combined Effects of Fineness Ratio and Bubble Fence on Dynamic Stability: $V = 200 \text{ FPS}$, Stabilizer = 2.0-Caliber Ballute



$V = 100 \text{ FPS}$
 2.0-CALIBER BALLUTE
 $\ell/d = 7.7$

Figure 262. Effects of Boattail Length on Dynamic Stability: $V = 100 \text{ FPS}$,
 2.0-Caliber Ballute $\ell/d = 7.7$



$V = 200$ FEET PER SECOND

2.0-CALIBER BALLUTE

$\ell/d = 7.8$

Figure 263. Effects of Boattail Length on Dynamic Stability:
 $V = 200$ Feet per Second, 2.0-Caliber Ballute $\ell/d = 7.8$

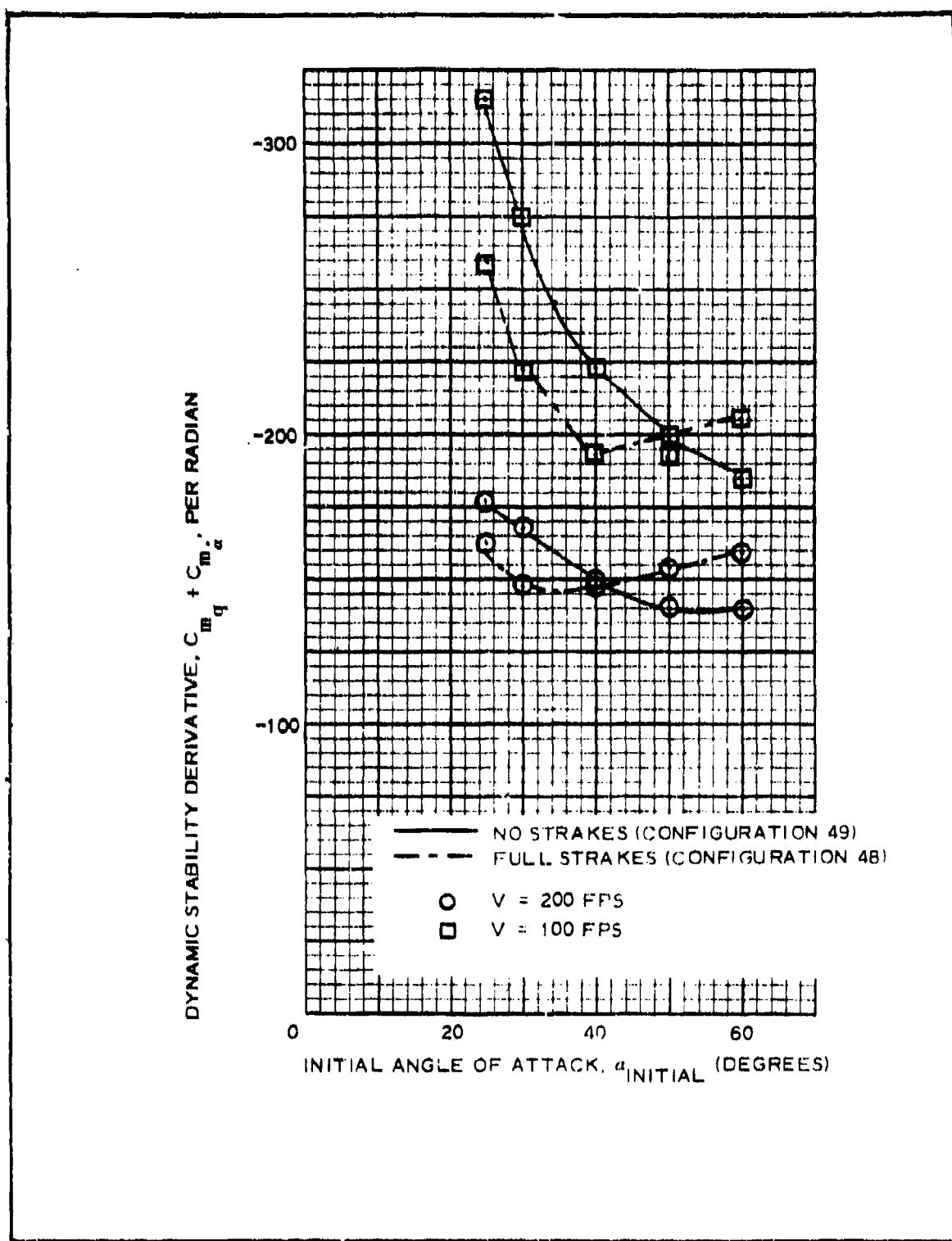


Figure 264. Effects of Boat Tail Stakes on Dynamic Stability: 1-1/2-Caliber Ballute, 1-Caliber Boat Tail, $L/d = 7.7$

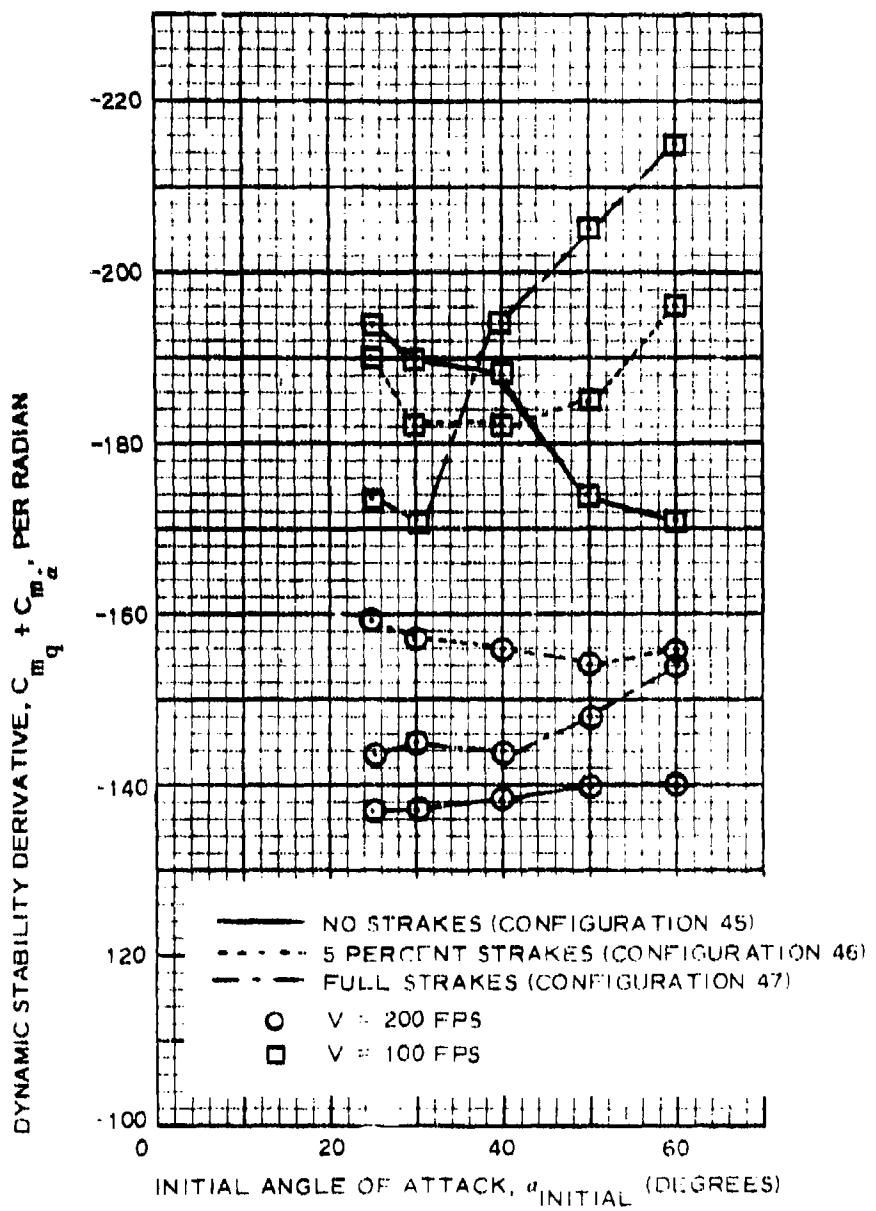


Figure 265. Effects of Boattail Strakes on Dynamic Stability: 1-1/2-Caliber Ballute, 1-2/3-Caliber Boattail, 2.0-Caliber Ogive Nose,

$\lambda d = 7.7$

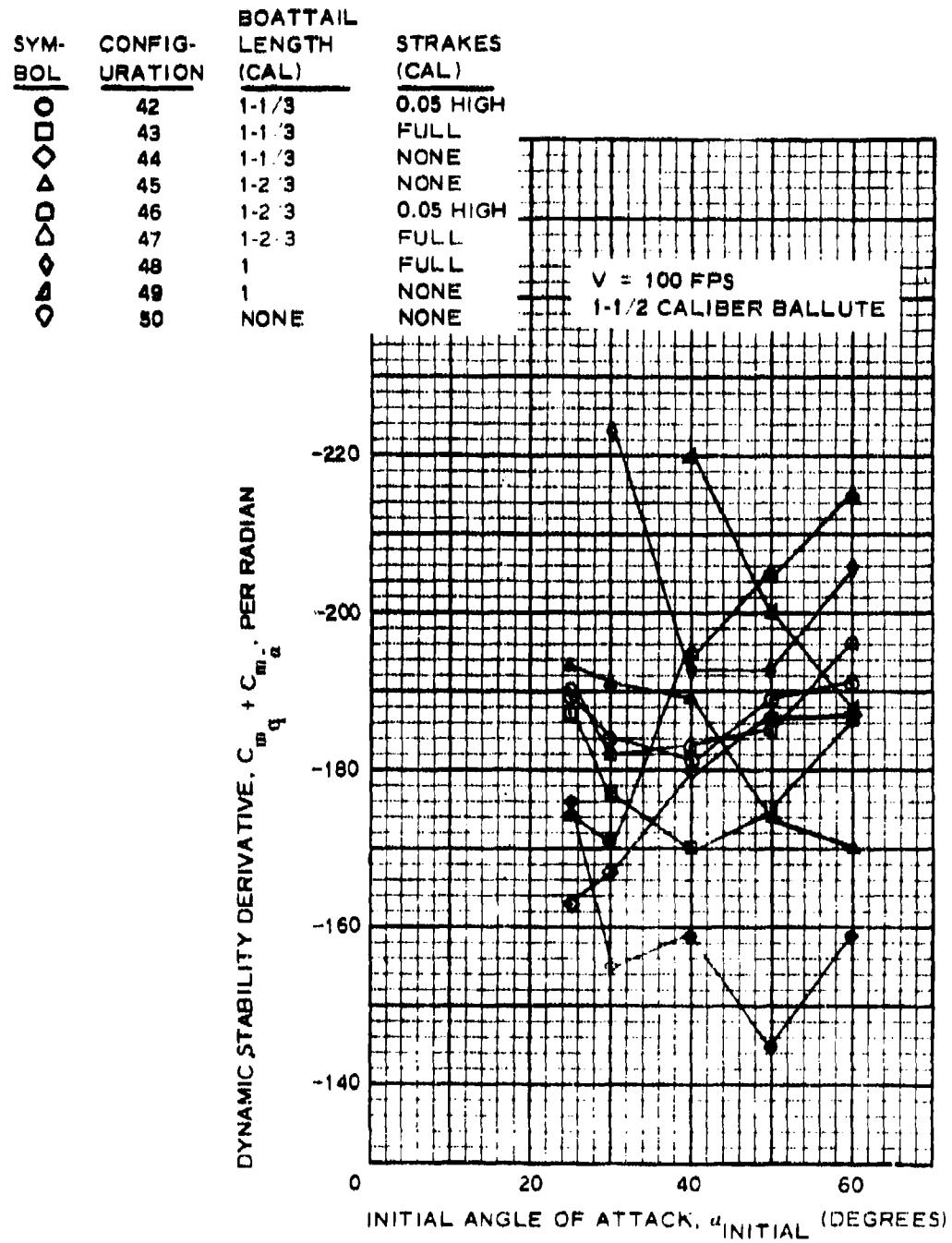


Figure 266. Effect of Various Boattail Characteristics on Dynamic Stability:
 $V = 100 \text{ FPS}$, $1\frac{1}{2}$ -Caliber Ballute

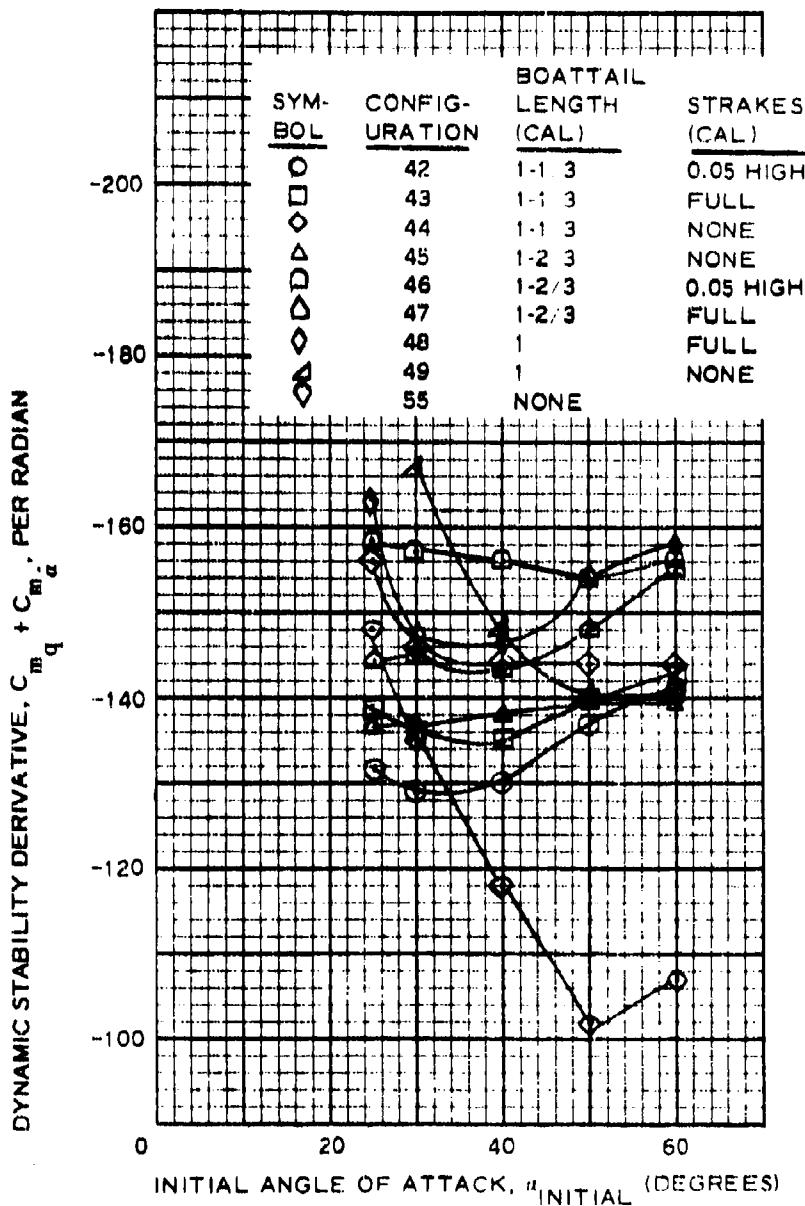
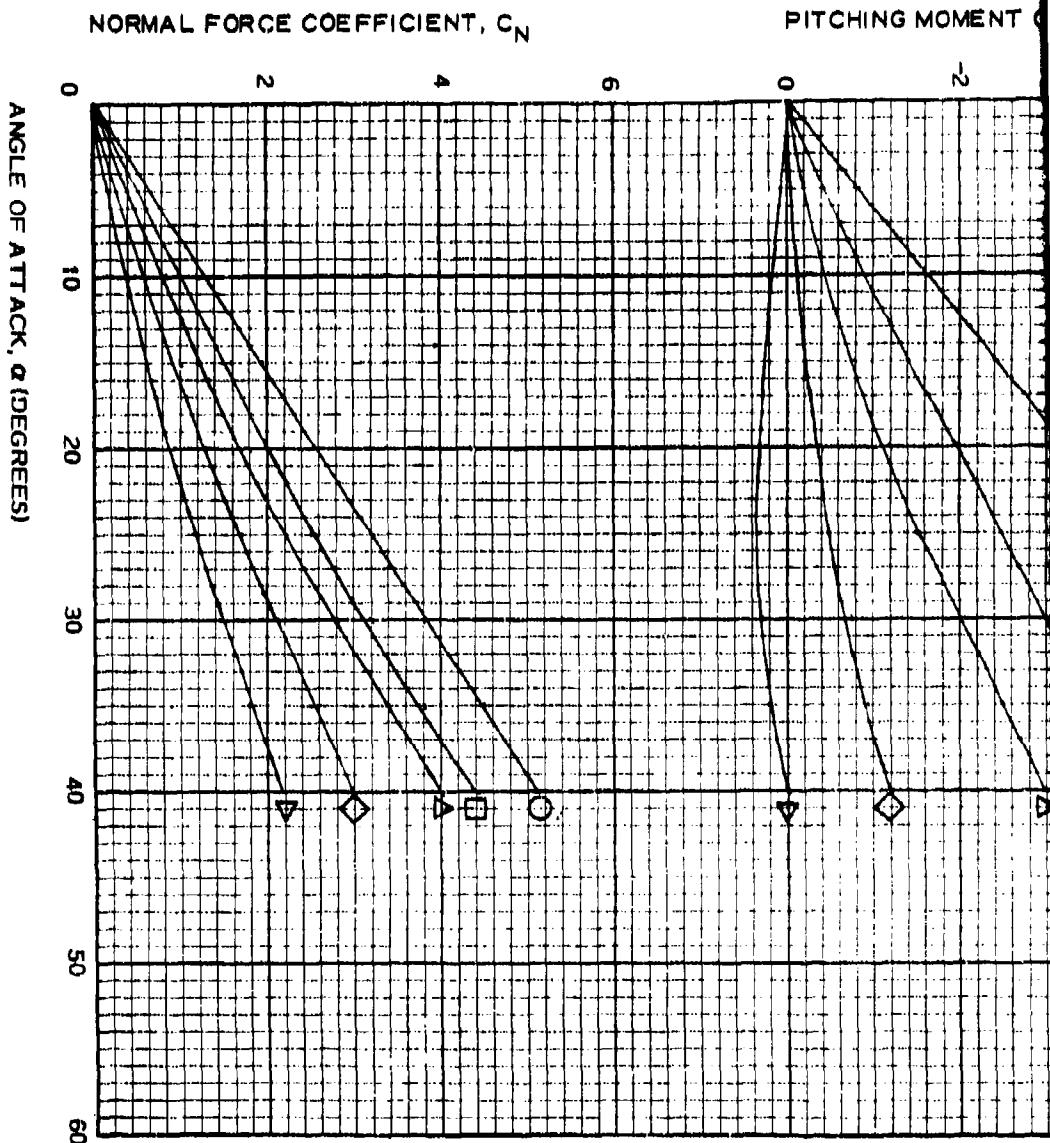


Figure 267. Effects of Various Boattail Characteristics on Dynamic Stability:
 $V = 200$ FPS, 1-1/2-Caliber Ballute



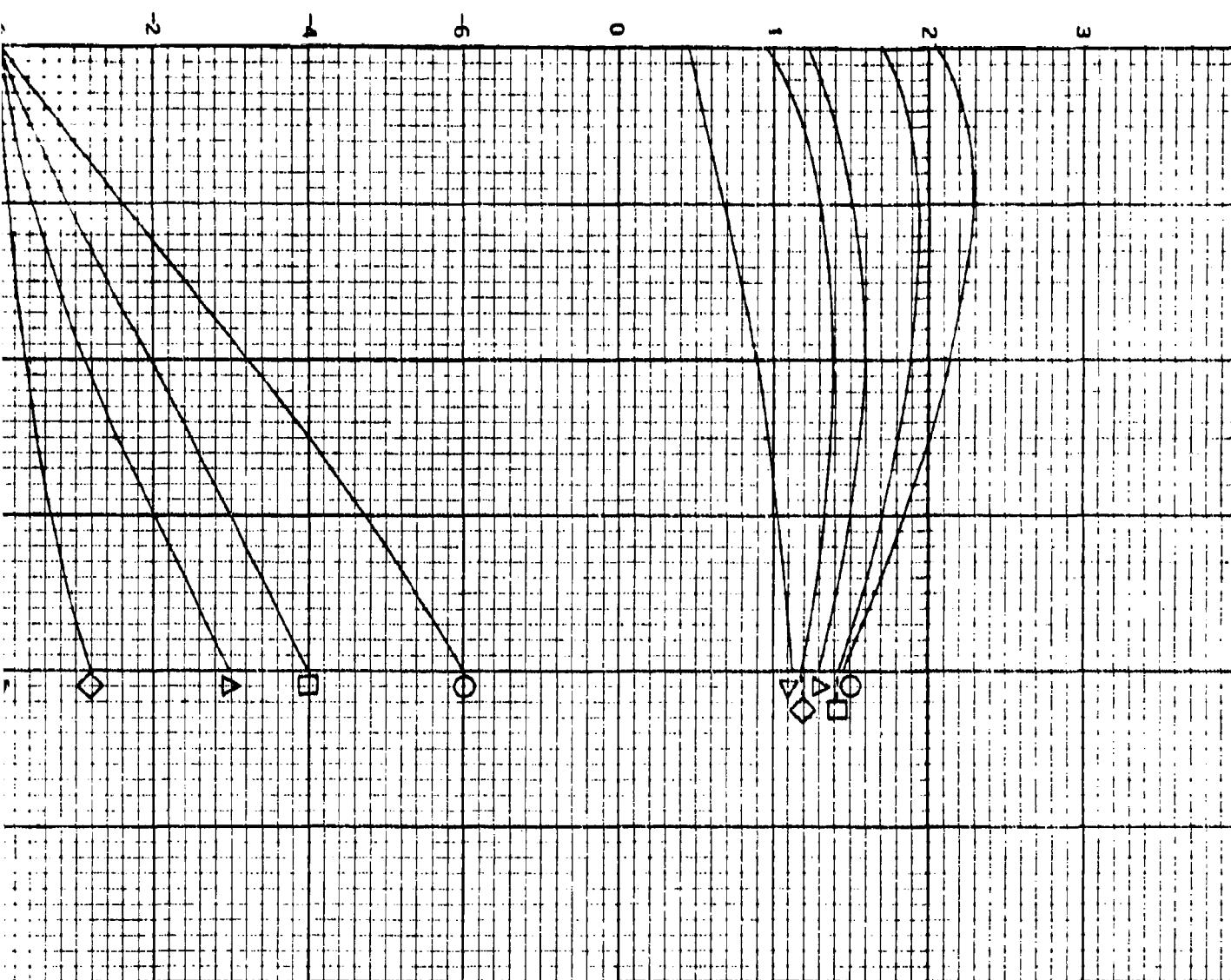
SYM- BOL	CONFIG- URATION	BALLUTE (CAL)	FENCE (CAL)	AFT
93		2.27	2.28	
91		2.02	2.01	
89		1.79	1.77	
87		1.55		
95	NO BALLUTE	1.50		

$S_{REF} = \frac{\pi D^2}{4}$ CYLINDER

$\ell_{REF} = D$ CYLINDER

PITCHING MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

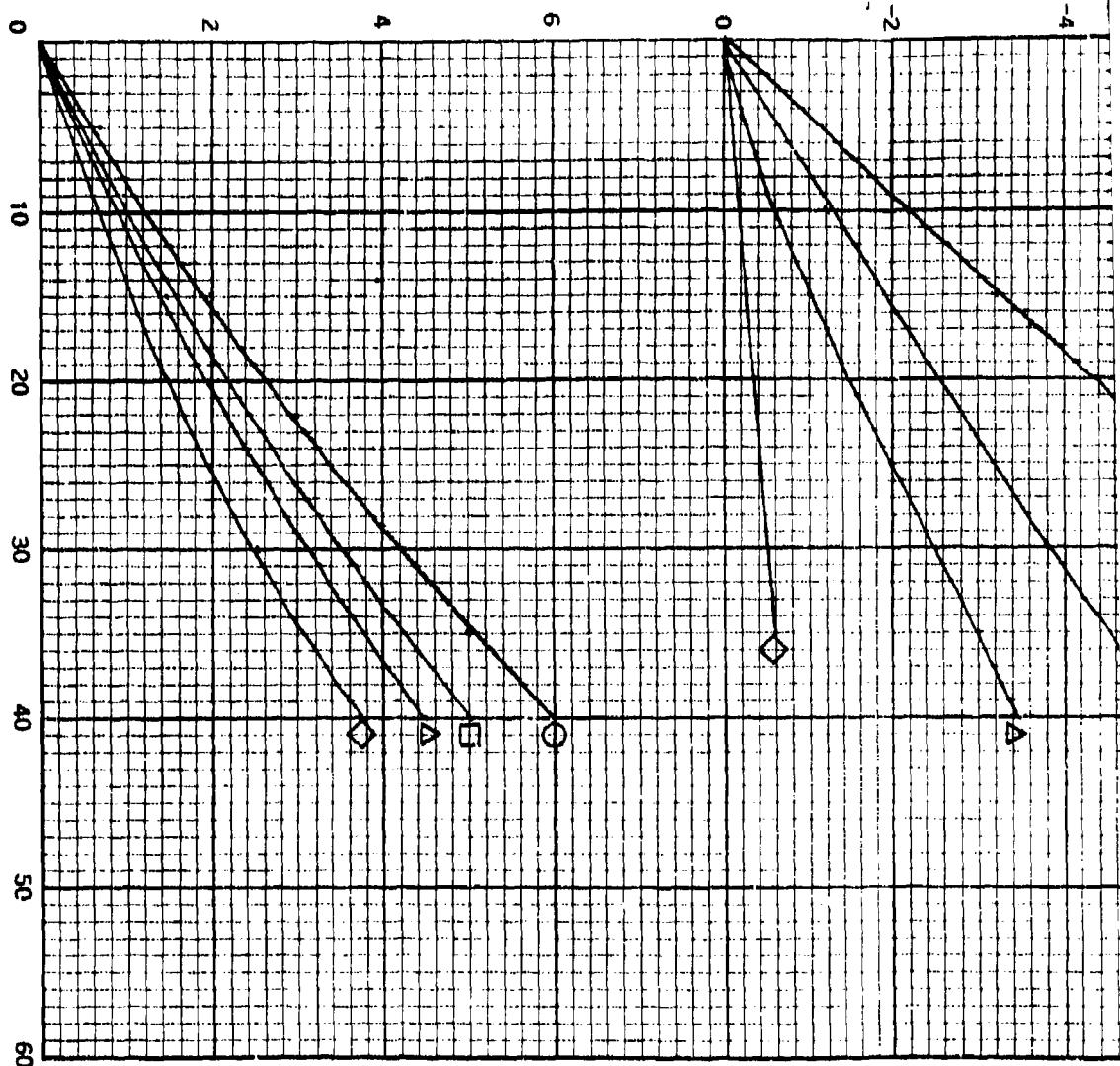


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Figure 268. Effect of Ballute Size on Static Aerodynamics of
3.0-Caliber Flat-Nosed Bomb with 1.1 Caliber
Trip and Ballute Stabilizer with Fence

NORMAL FORCE COEFFICIENT, C_N

PITCHING MOMENT COEFFICIENT

ANGLE OF ATTACK, α (DEGREES)

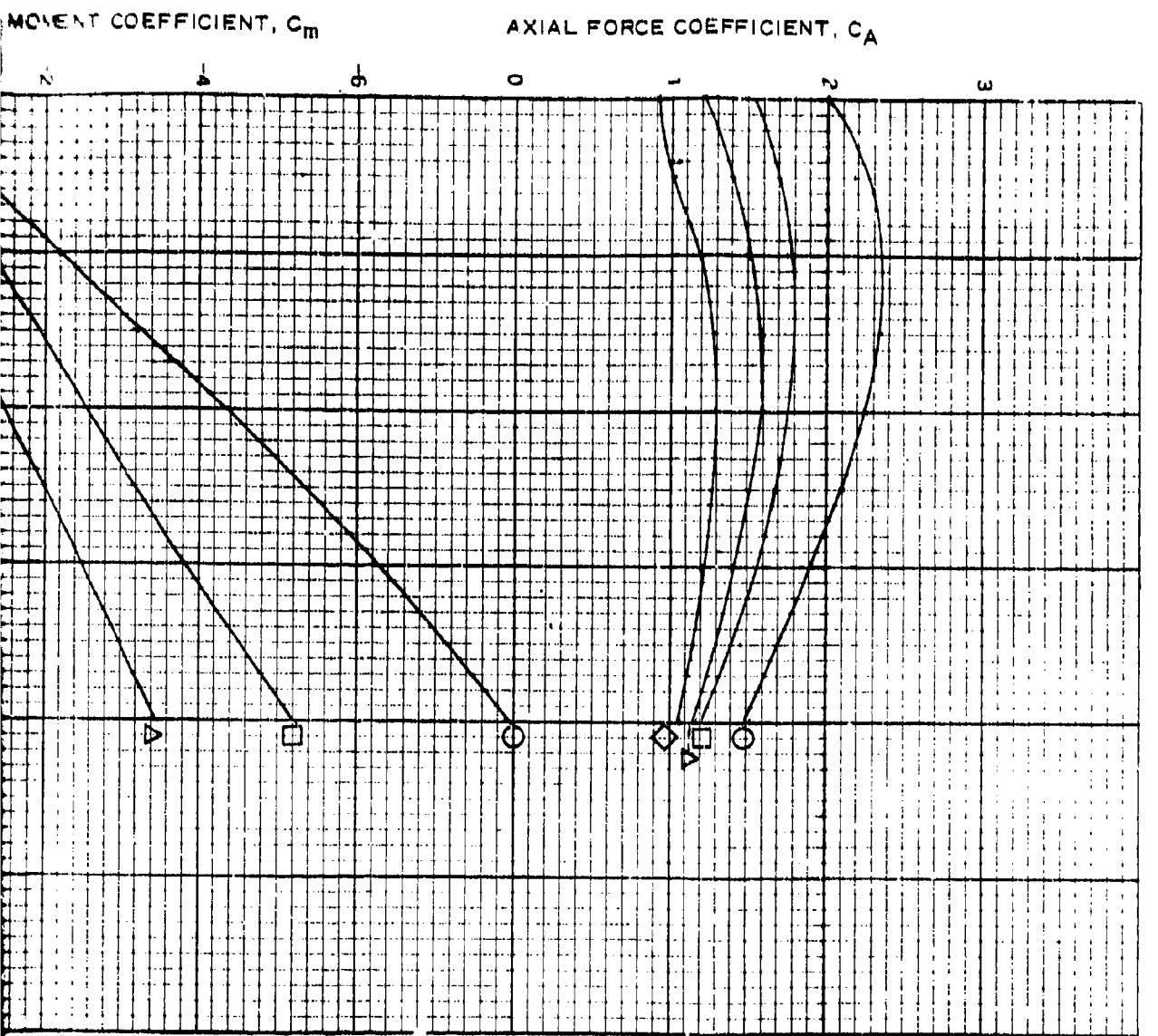
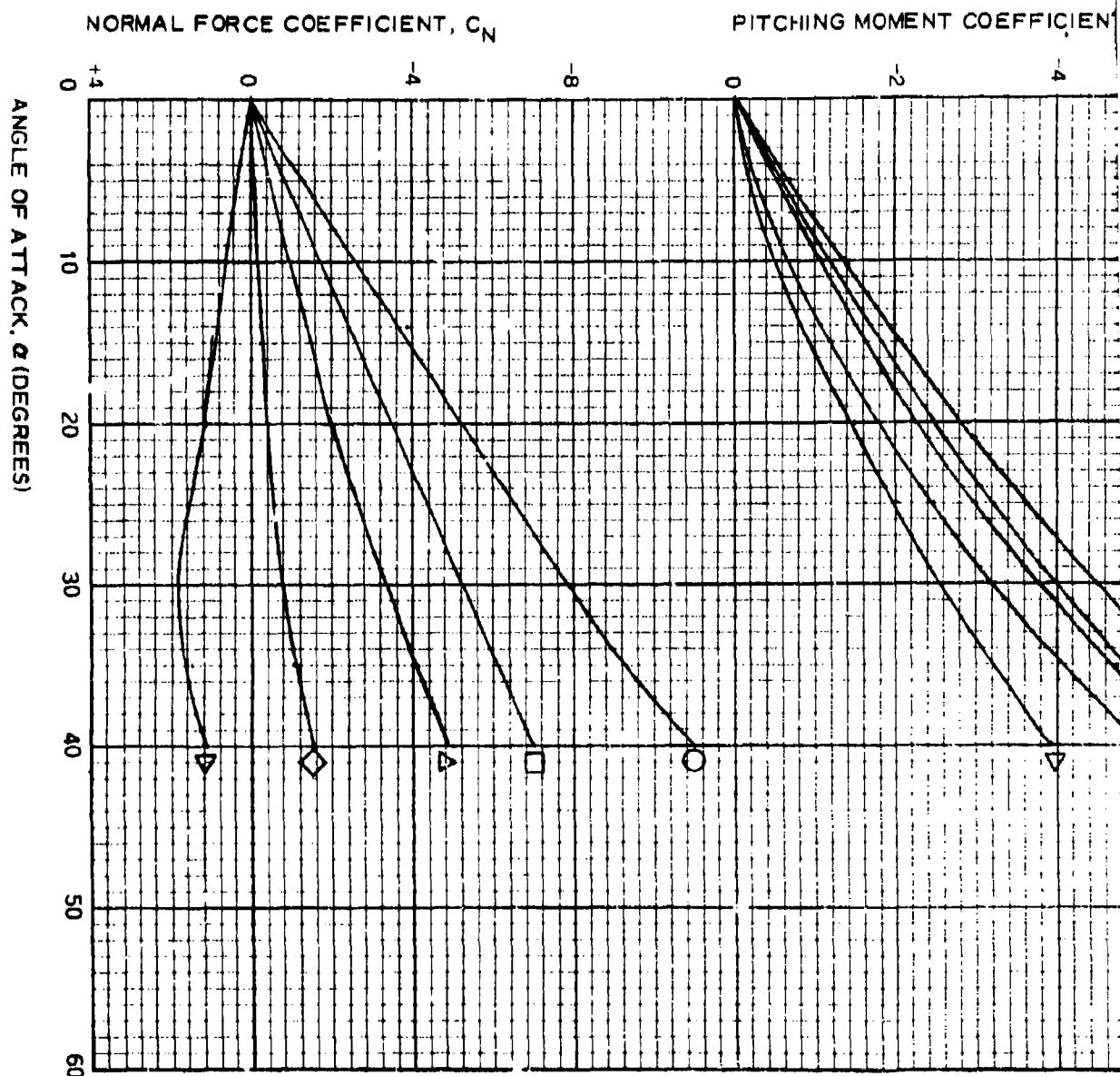


Figure 269. Effect of Ballute Size on Static Aerodynamics
of 5.0-Caliber Flat-Nosed Bomb with 1.1-Caliber
Trip Ring and Ballute Stabilizer with Fence

▽ ◇ ▷ □ ○



$$S_{REF} = \frac{\pi D^2}{4}$$

S_{REF} = CYLINDER

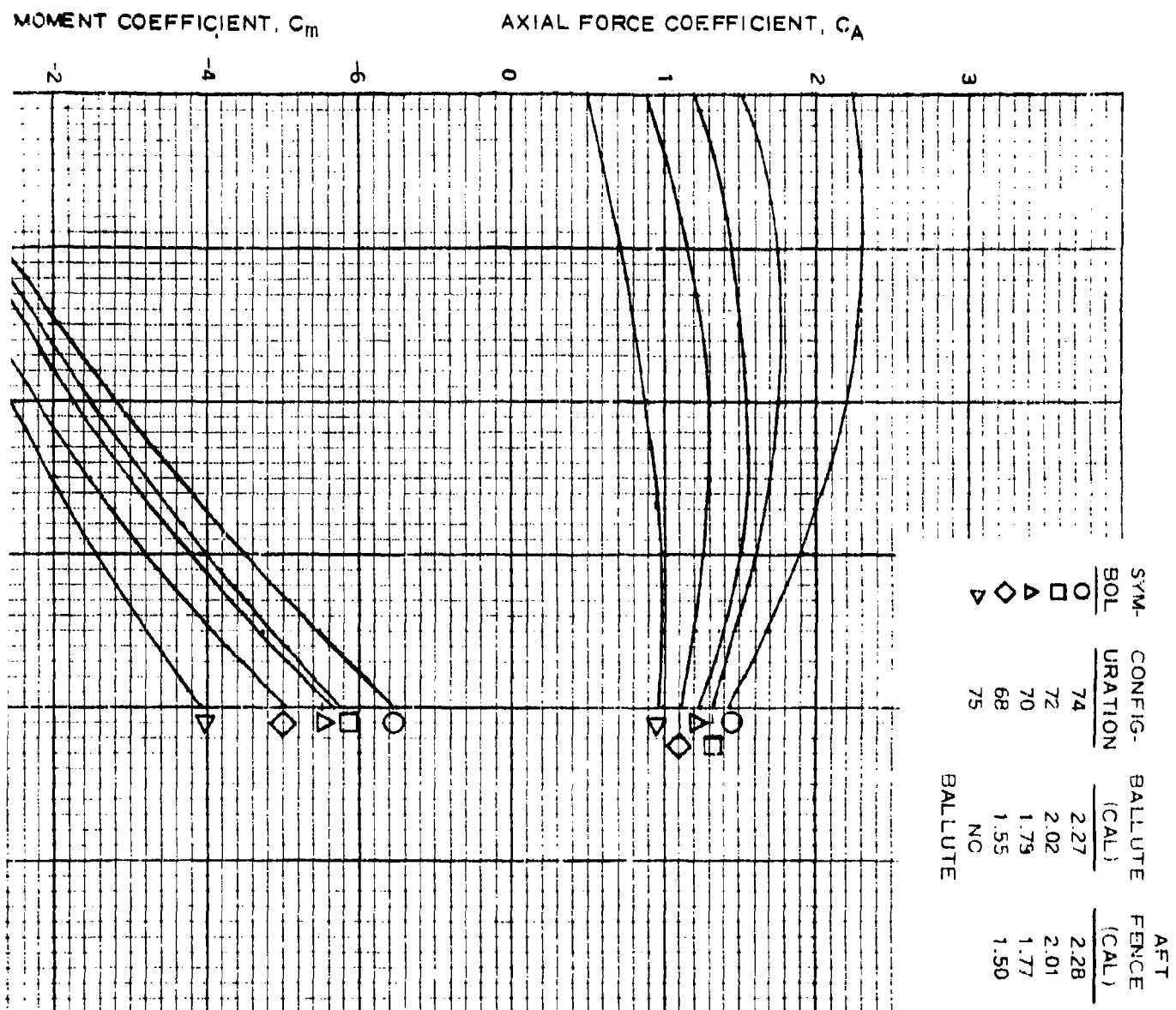
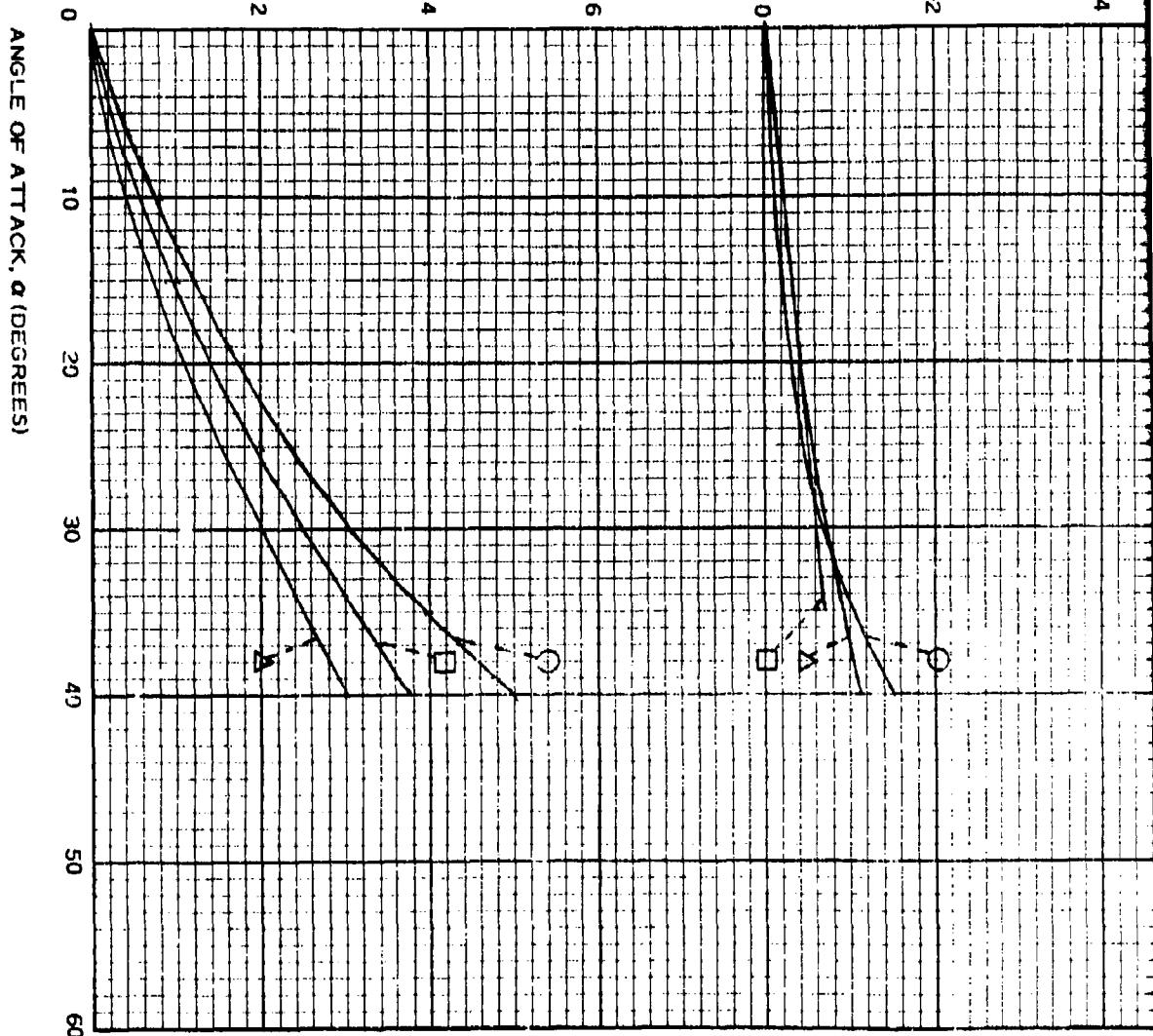


Figure 270. Effect of Ballute Size on Static Aerodynamics of 7.0-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip Ring and Ballute Stabilizer with Fence

NORMAL FORCE COEFFICIENT, C_N PITCHING MOMENT COEFFICIENT, C_M 

$$S_{REF} = \frac{\pi D^2}{4} CYLINDER$$

$\int_{REF} = D$ CYLINDER

MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

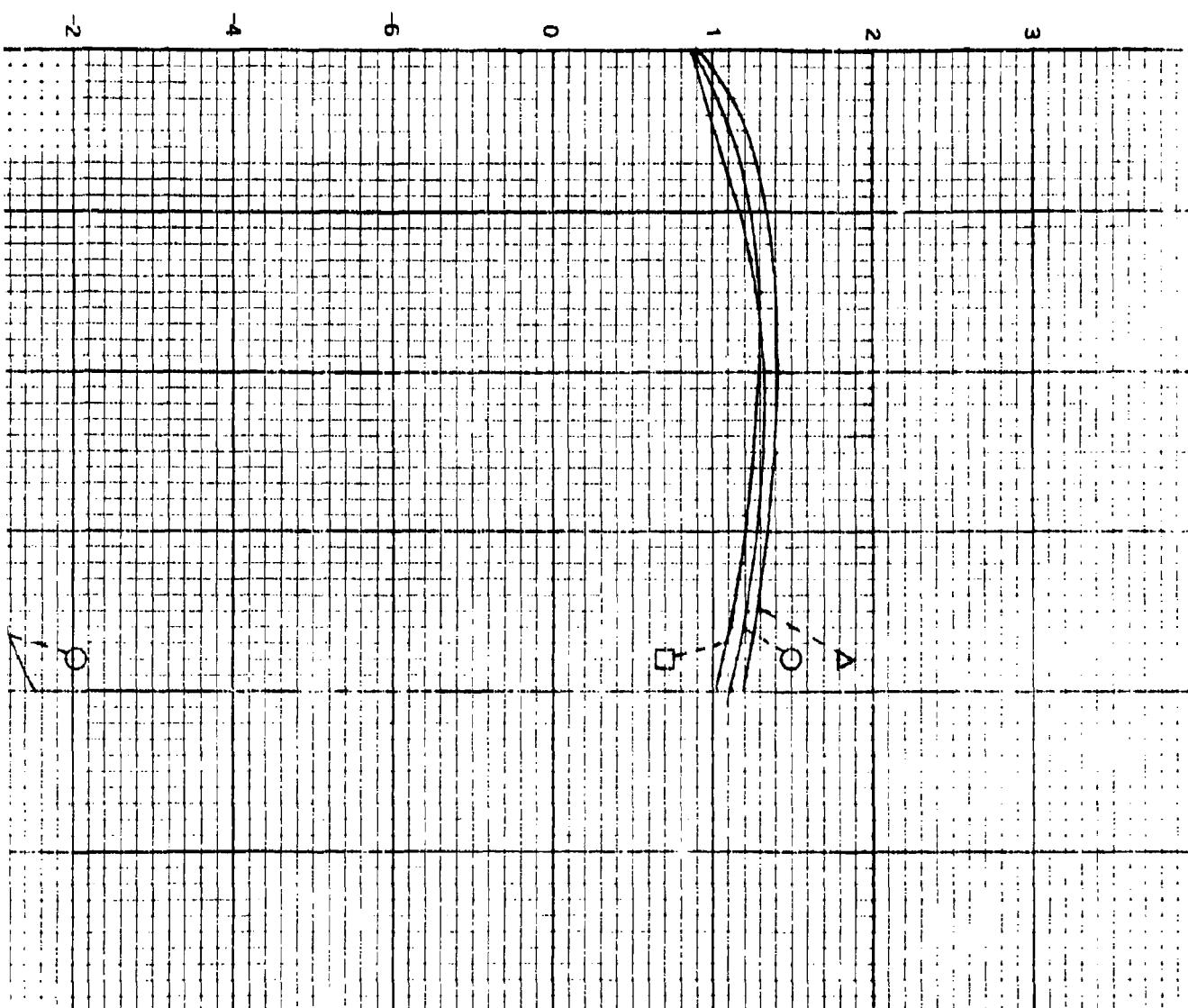
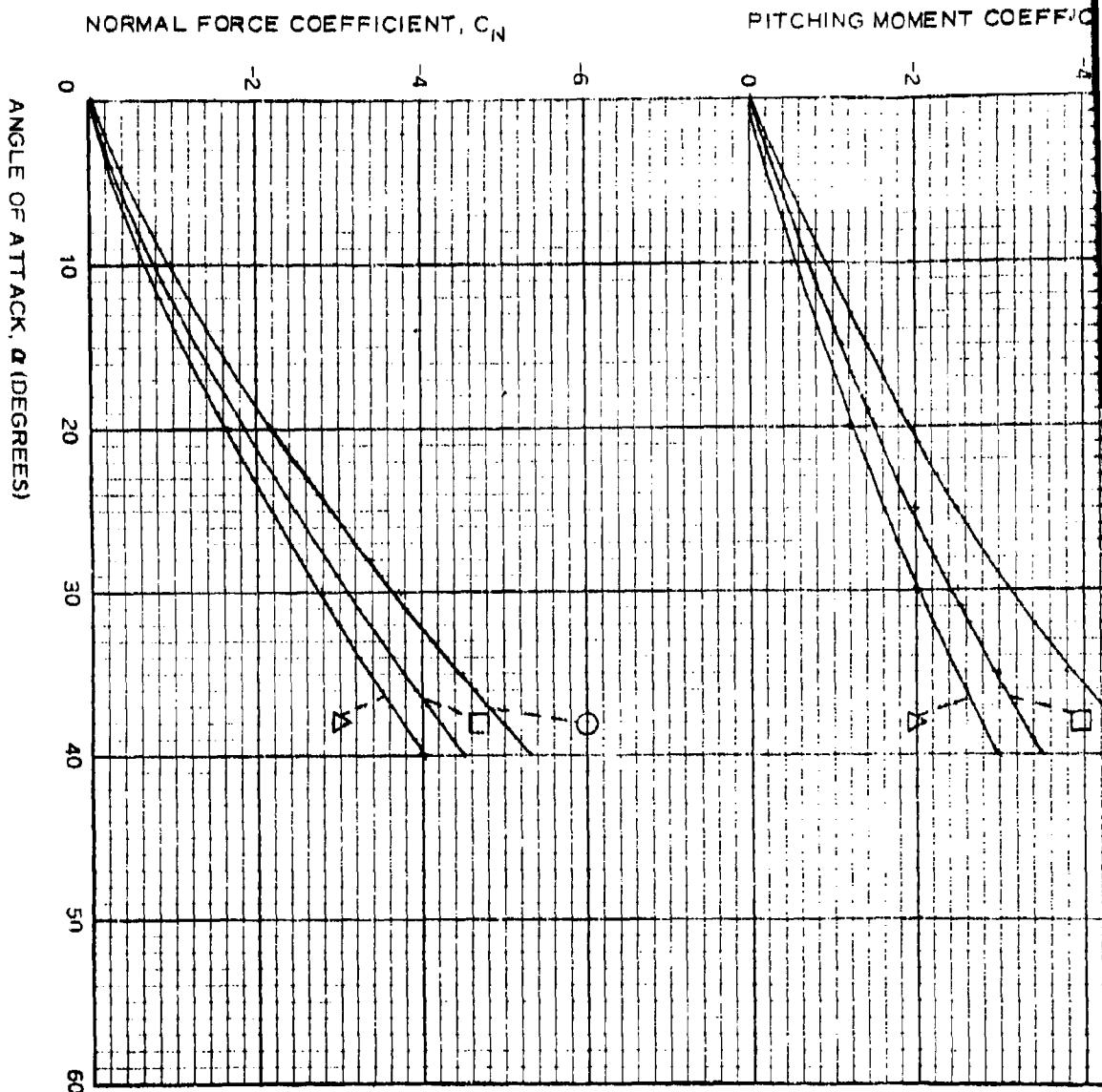


Figure 271. Effect of Fineness Ratio on Static Aerodynamics
of Flat-Nosed Bomb with 1.1-Caliber Trip Ring
and 1.5-Caliber Ballute Stabilizer with Aft Fence



SYM- BOL	CONFIG- URATION	C_N
O	70	7.0
□	60	5.0
A	89	3.0

$$S_{REF} = \frac{\pi D^2}{4}$$

CYLINDER

S_{REF} = D CYLINDER

MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

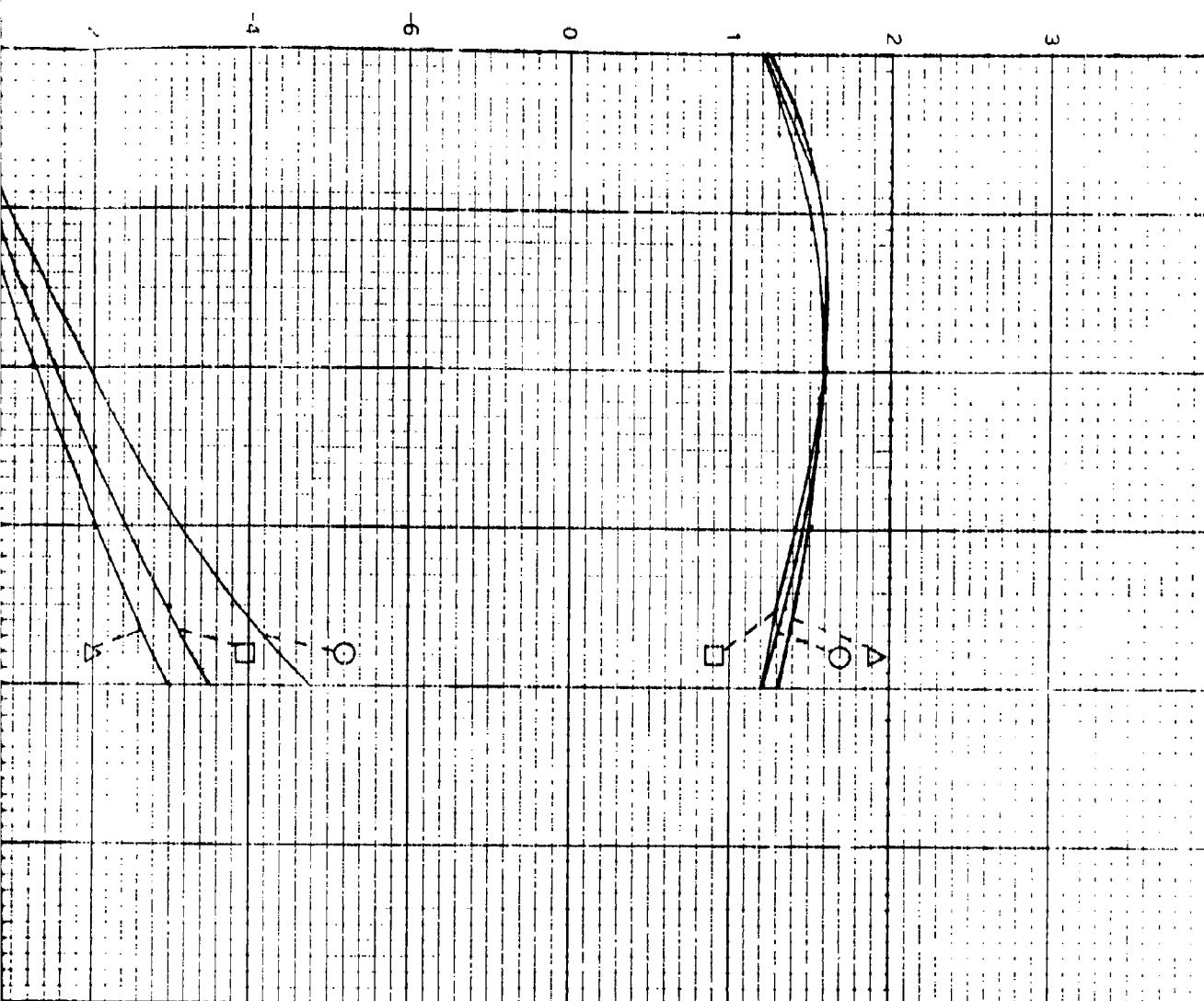
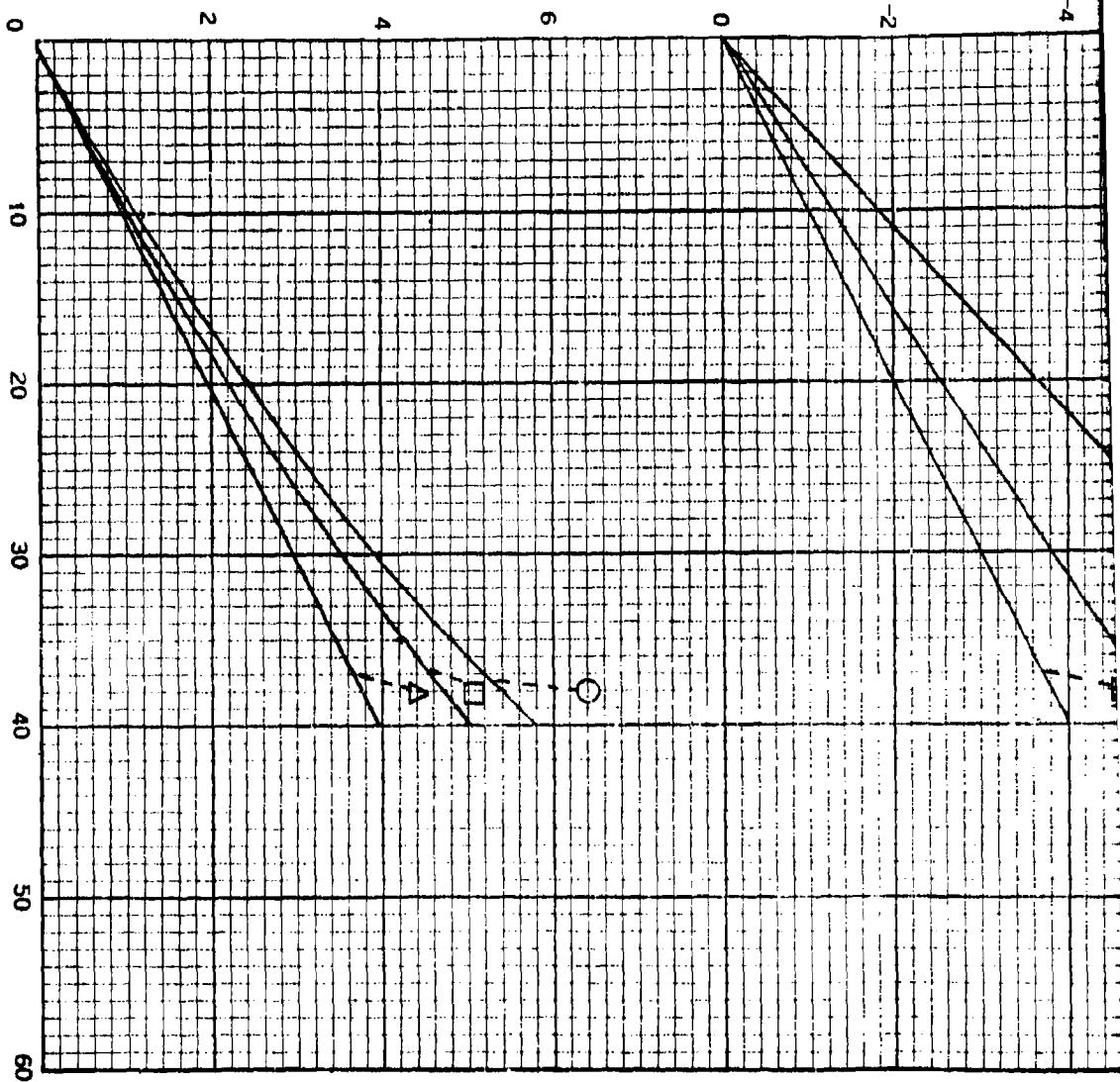


Figure 272. Effect of Fineness Ratio on Static Aerodynamics of Flat-Nosed Bomb with Trip Ring and 1.75 Caliber Ballute Stabilizer with Aft Fence

NORMAL FORCE COEFFICIENT, C_N

PITCHING MOMENT COEFFICIENT, C_Q

ANGLE OF ATTACK, α (DEGREES)



MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

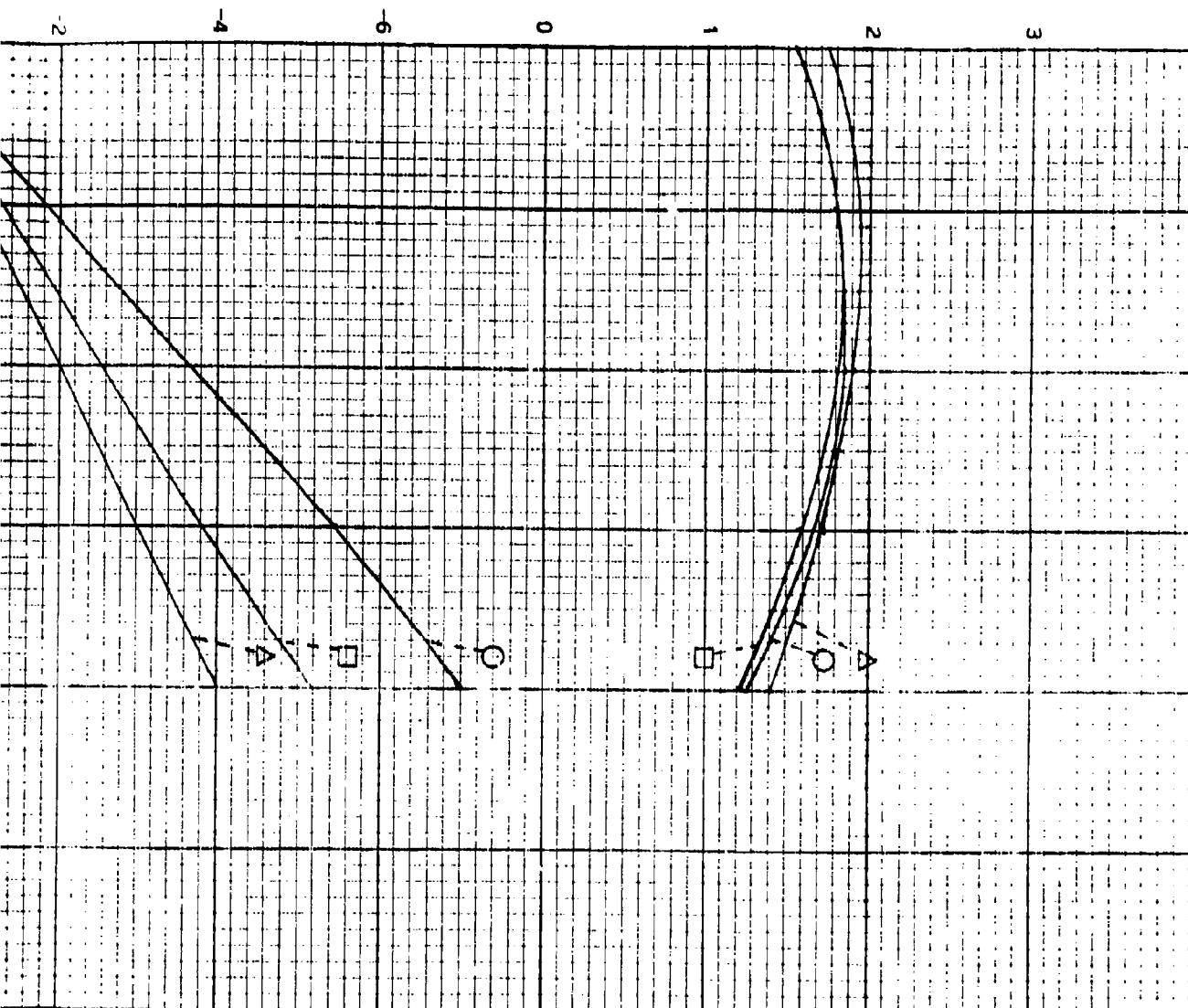
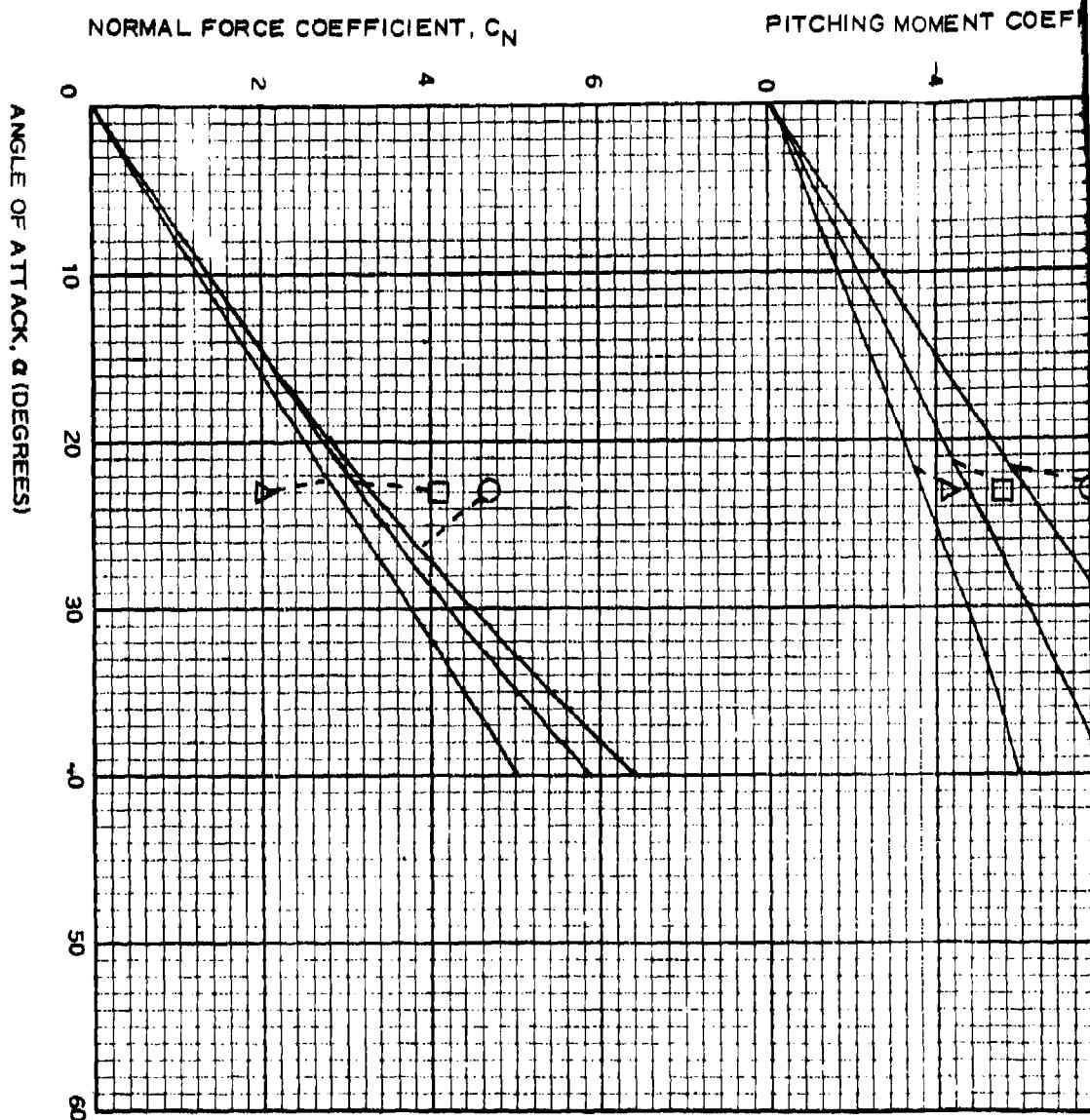


Figure 273. Effect of Fineness Ratio on Static Aerodynamics
of Flat-Nosed Bomb with 1.1-Caliber Trip Ring and
2.0-Caliber Ballute with Aft Fence



SYM- BOL	CONFIG- URATION	L/D
74		7.0
93		5.0
84		3.0

$S_{REF} = \frac{\pi D^2}{4}$ CYLINDER

$L_{REF} = D_{CYLINDER}$

MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

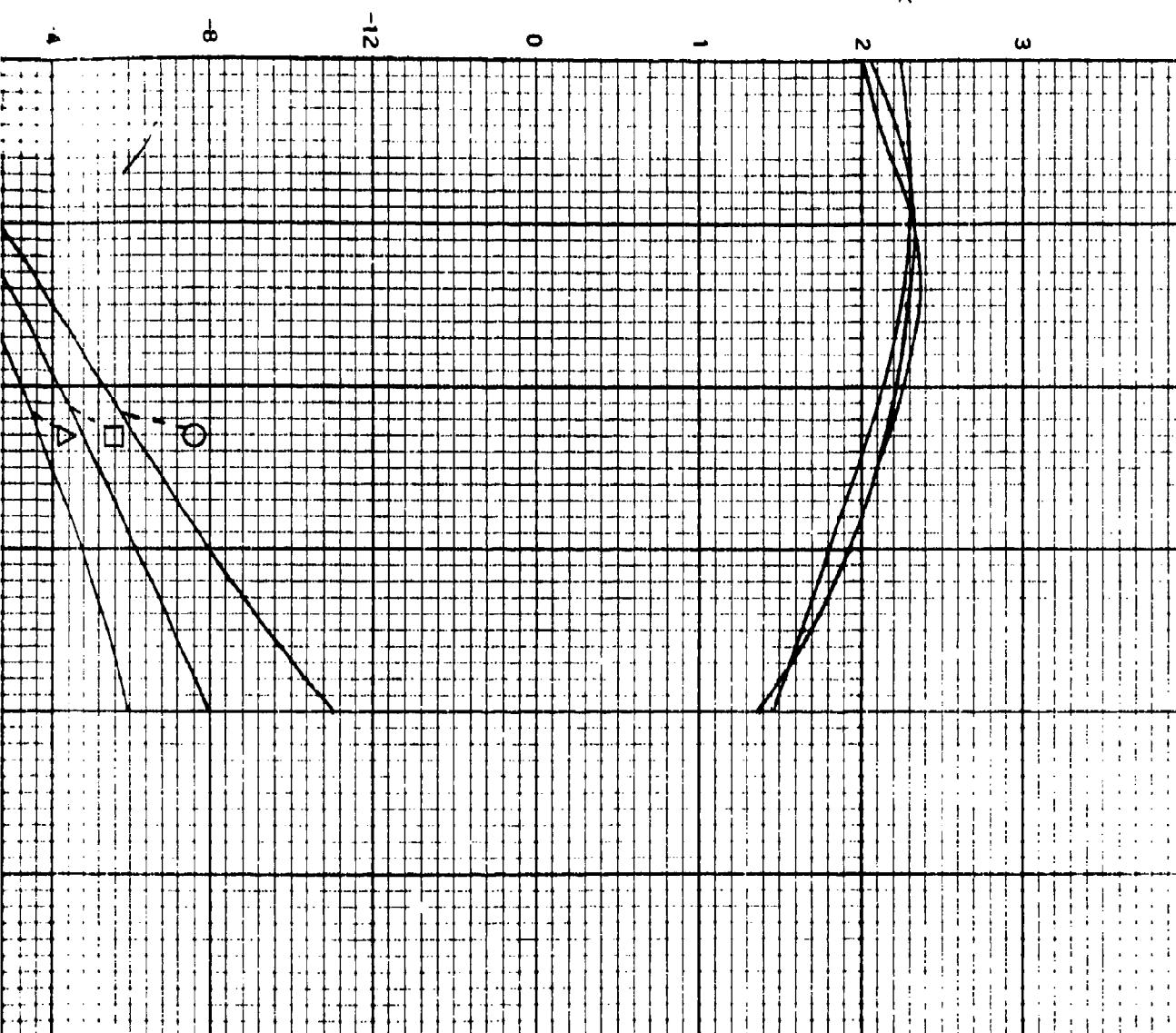
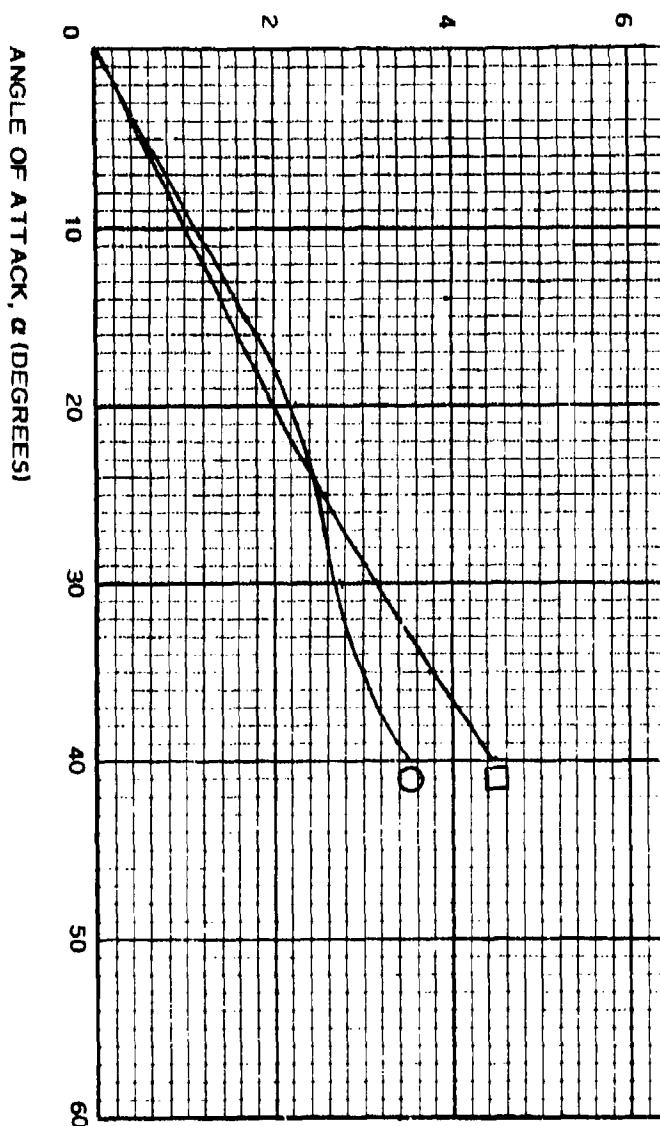
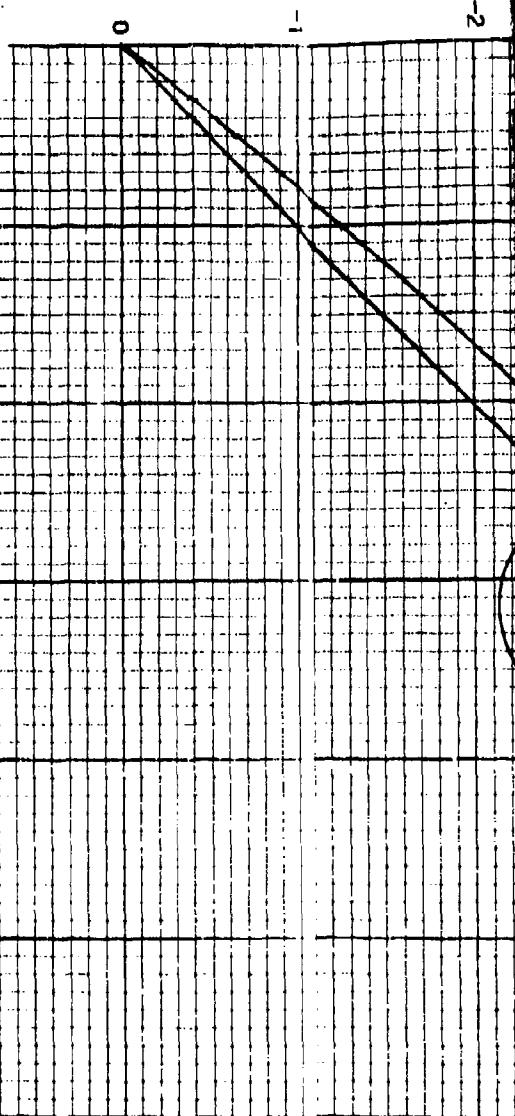


Figure 274. Effect of Fineness Ratio on Static Aerodynamics
of Flat-Nosed Bomb with 1.1-Caliber Trip Ring and
2.27-Caliber Ballute with Aft Fence

NORMAL FORCE COEFFICIENT, C_N 

PITCHING MOMENT COEFFICIENT

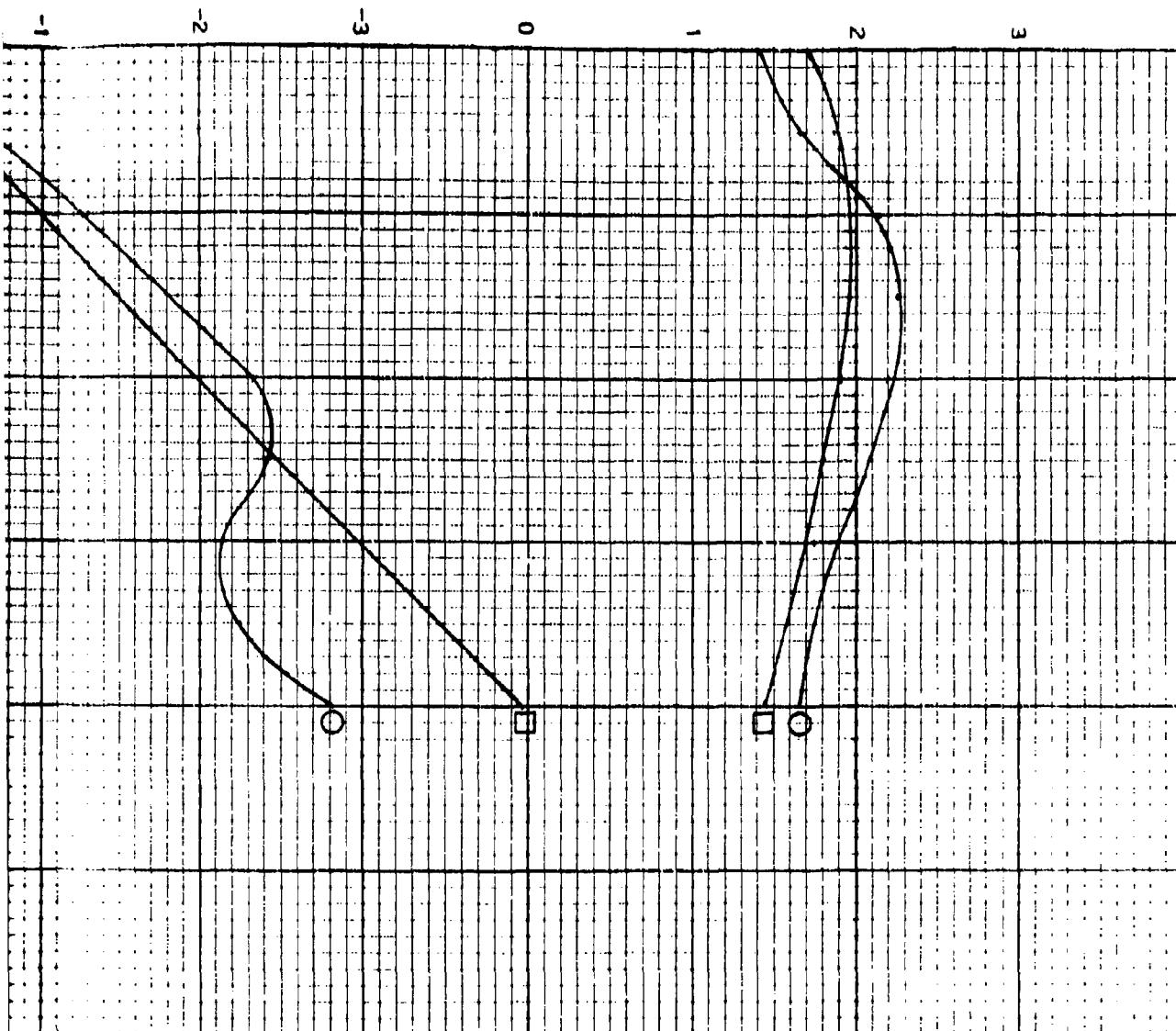


SYM- BOL	CONFIG- URATION	FENCE TYPE	$S_{REF} = \frac{\pi D^2}{4}$
90	BURBLE		
91	AFT		

$S_{REF} = \frac{\pi D^2}{4}$
 $D_{CYLINDER}$

MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

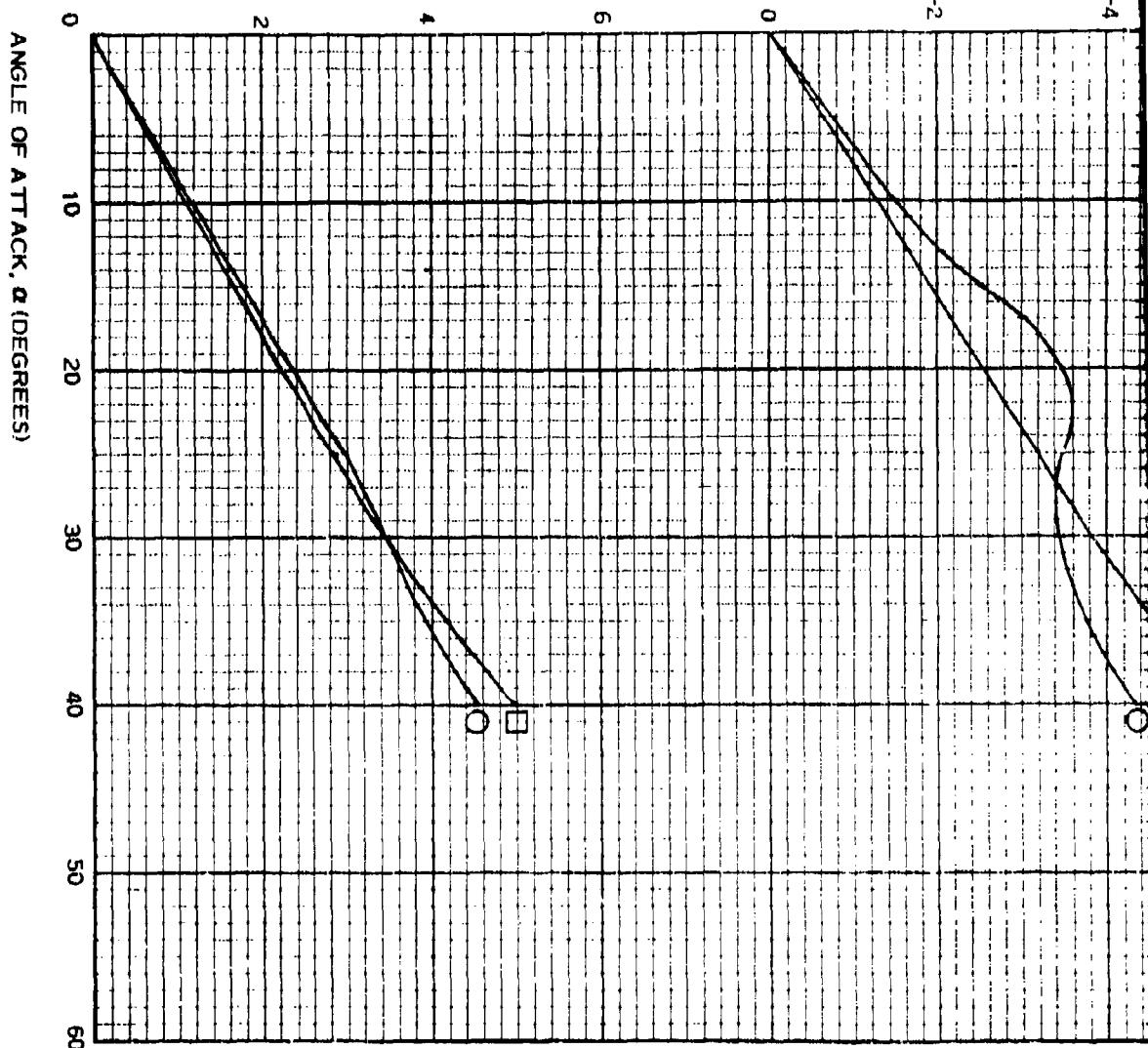


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Figure 275. Effect of Burble Fence on the Static Aerodynamics
of a 3.0-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip
Ring and 2.0-Caliber Ballute Stabilizer

NORMAL FORCE COEFFICIENT, C_N

PITCHING MOMENT COEFFICIENT



ANGLE OF ATTACK, α (DEGREES)

SYM- BCL	CONFIG- URATION	FENCE TYPE	$S_{REF} = \frac{\pi D^2}{4}$
B1		BURBLE	
B2	AFT		$S_{REF} = D_{CYLINDER}$

MOMENT COEFFICIENT, C_M

AXIAL FORCE COEFFICIENT, C_A

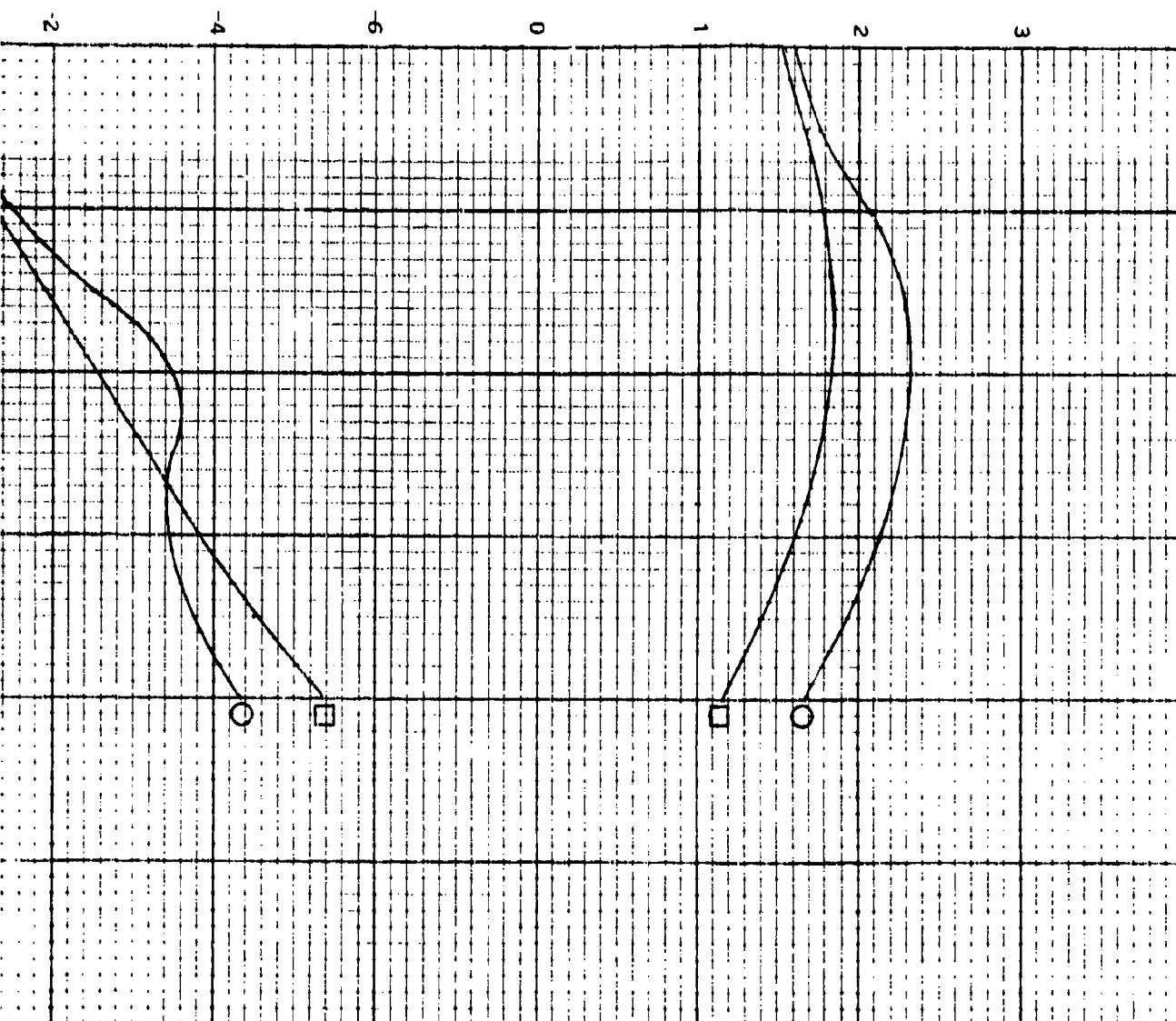
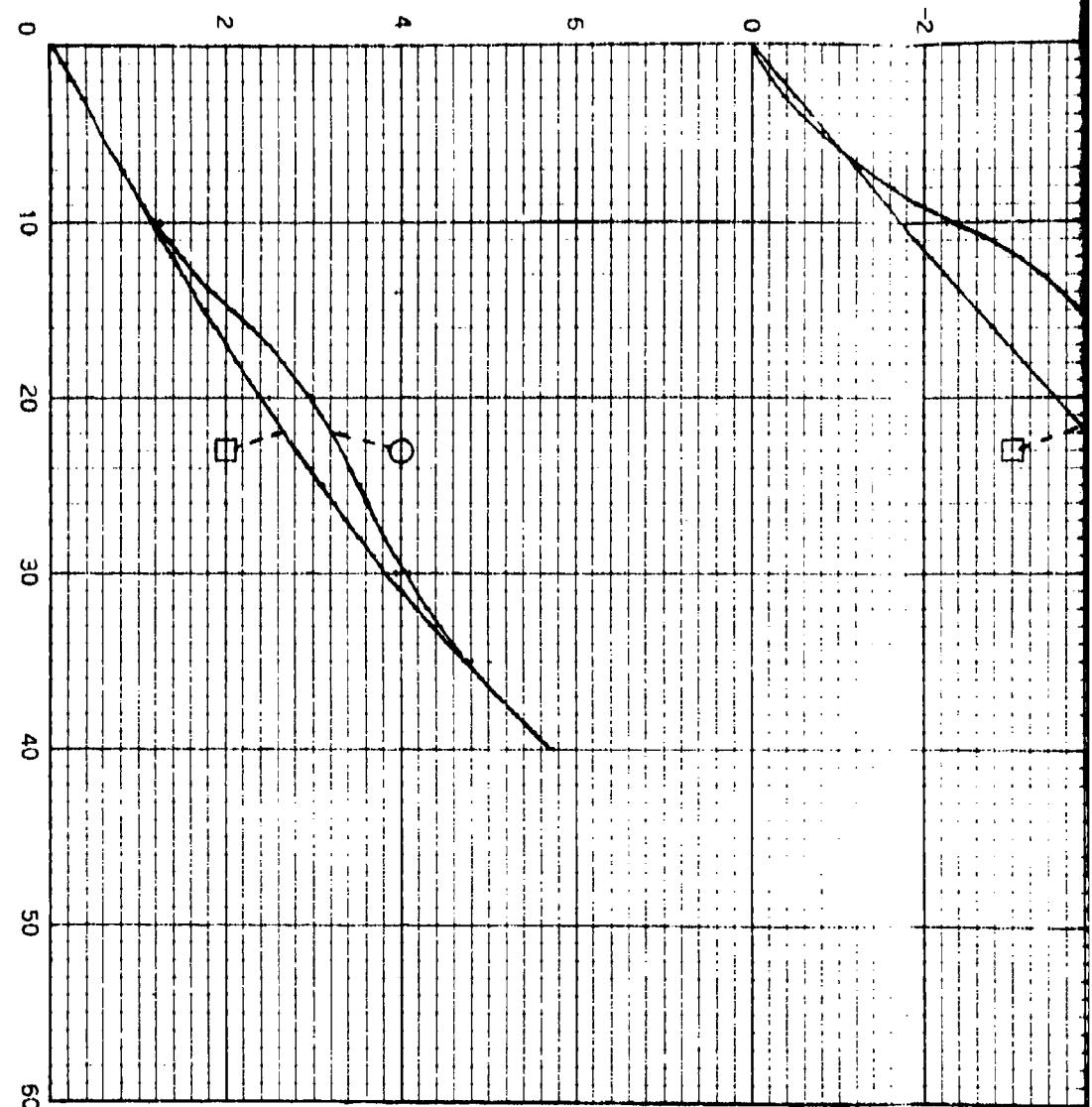


Figure 276. Effect of Burble Fence on the Static Aerodynamics
of a 5.0-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip
Ring and 2.0-Caliber Ballute Stabilizer

NORMAL FORCE COEFFICIENT, C_N

PITCHING MOMENT COEF.



ANGLE OF ATTACK, α (DEGREES)

SYM- BOL	CONFIG- URATION	FENCE TYPE	$S_{REF} = \frac{\pi D^2}{4}$
71	BURBLE		
72	AFT		

$$S_{REF} = \frac{\pi D^2}{4}$$

S_{REF} = $D_{CYLINDER}$

CHING MOMENT COEFFICIENT, C_{Mn}

AXIAL FORCE COEFFICIENT, C_A

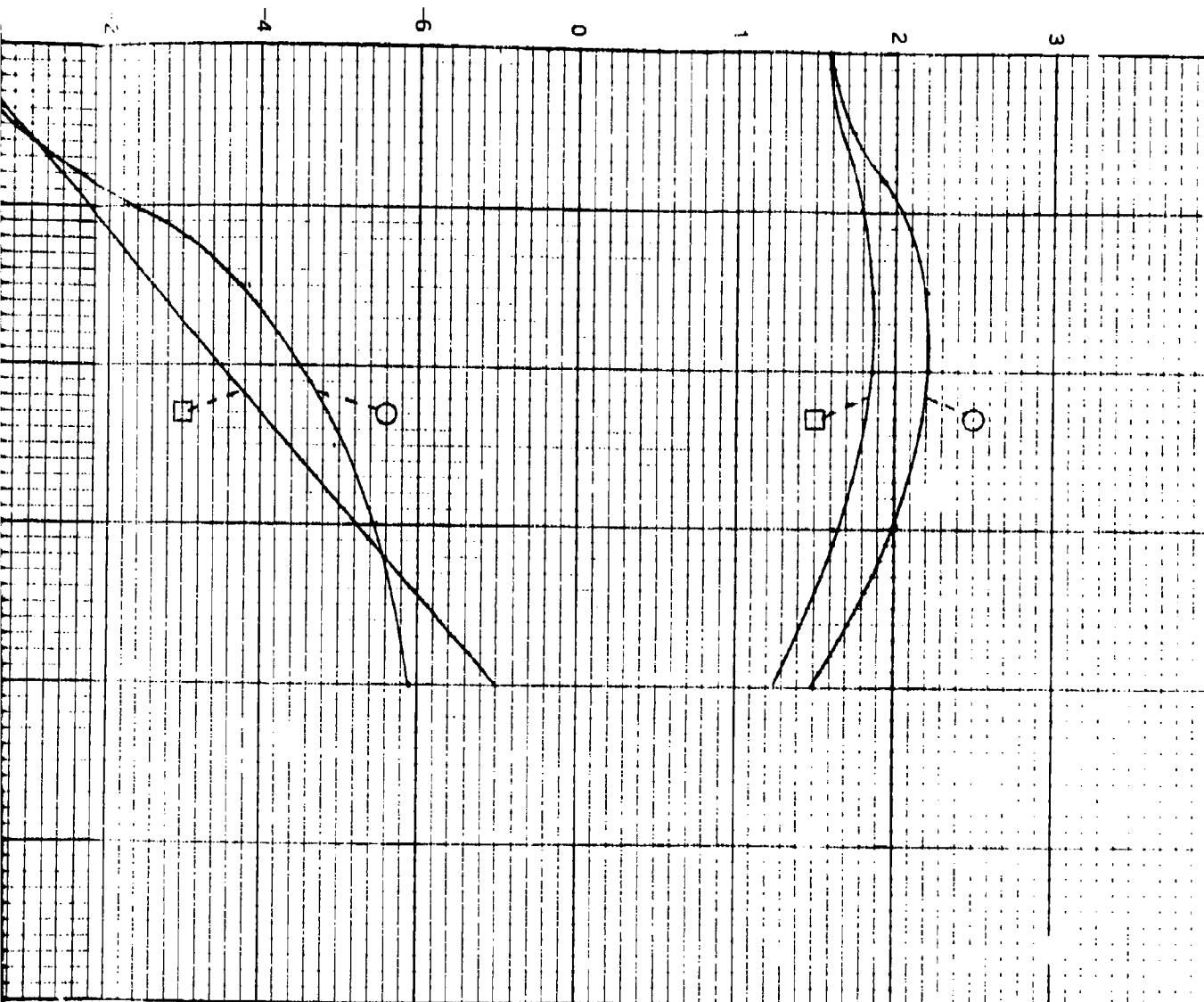
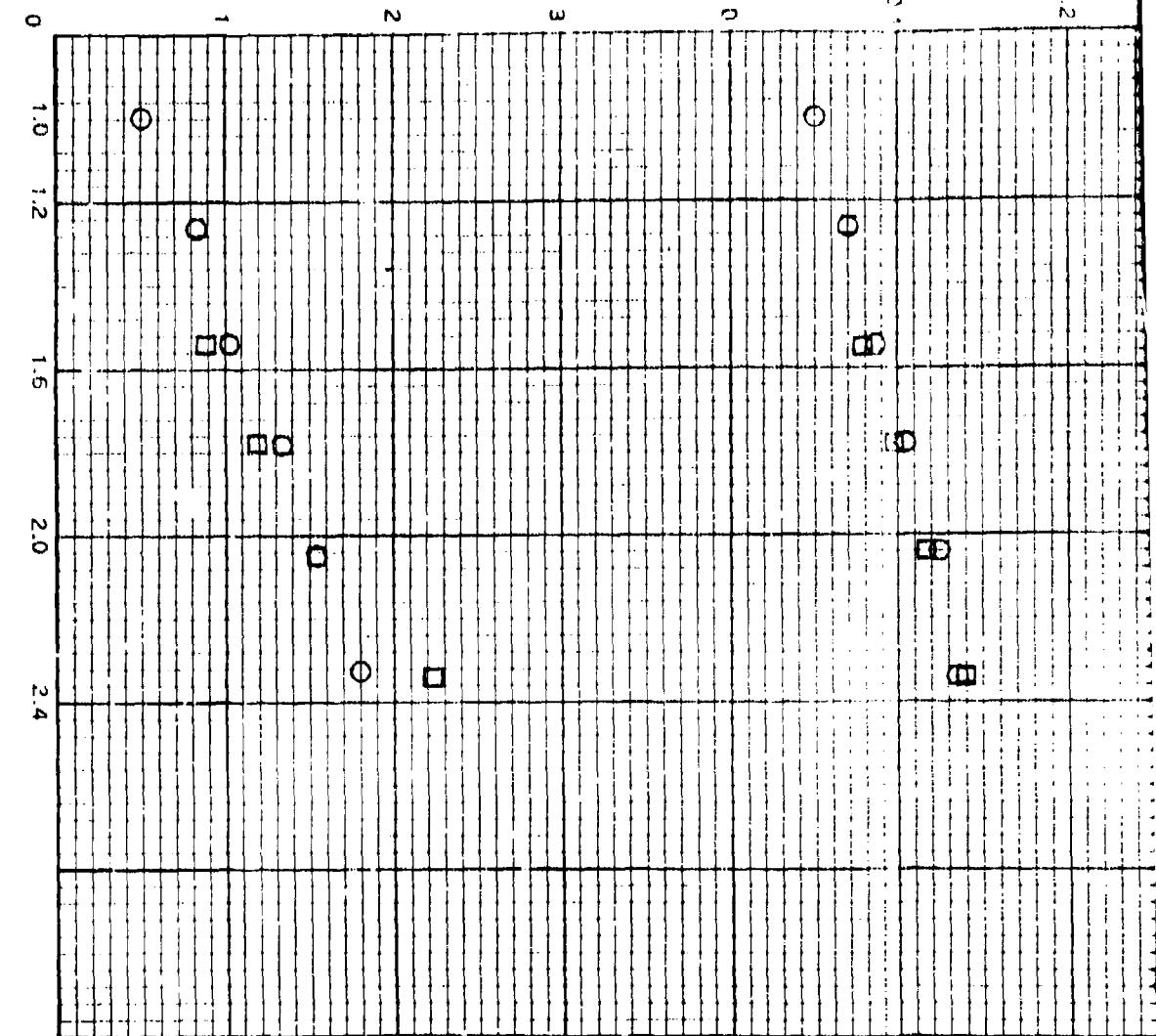


Figure 277. Effect of Burble Fence on the Static Aerodynamics of a 7.0-Caliber Modular Bomb and 2.0-Caliber Ballute

NORMAL FORCE COEFFICIENT

DRAG COEFFICIENT, $C_D_d = 0$



○ WITHOUT FENCE
□ WITH FENCE

• READ DIRECTLY BELOW A CONFIGURATION NUMBER TO
OBSERVE DATA FOR THAT CONFIGURATION.

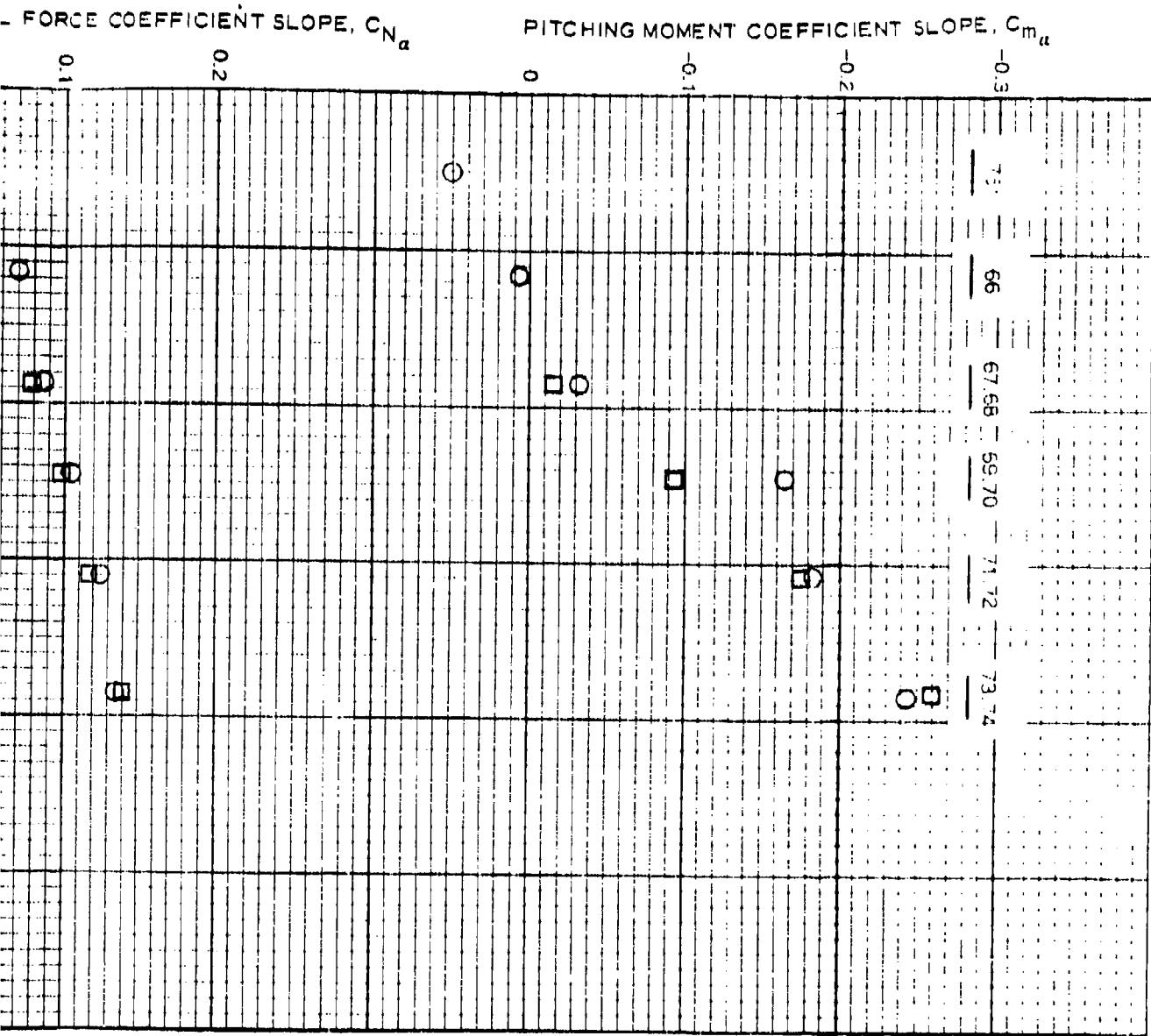
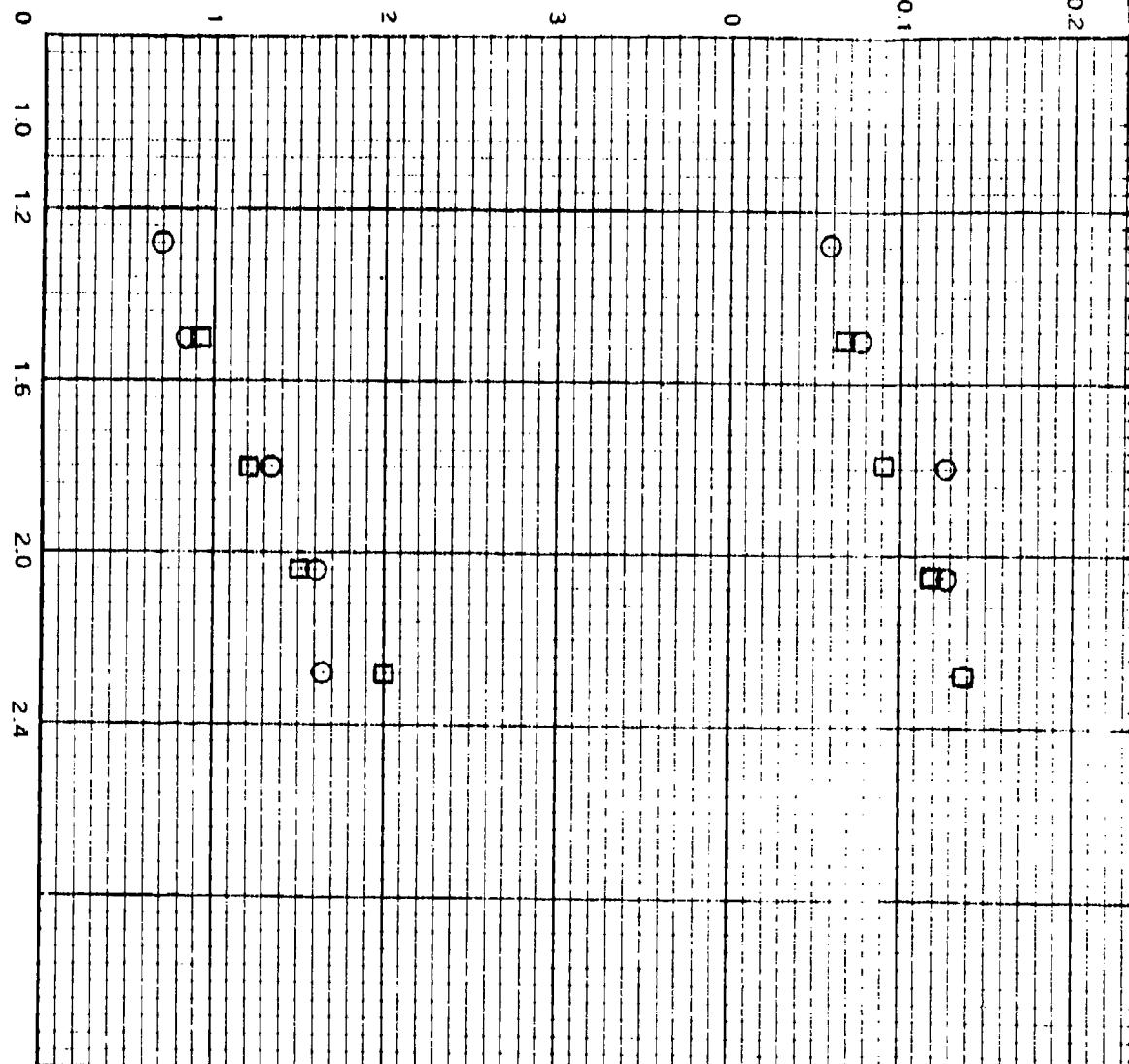


Figure 278. Effect of Bubble Fence on Static Aerodynamics of Various Size Ballutes

DRAG COEFFICIENT, $C_{D_n} = 0$

NORMAL FORCE COEFFICIENT



BALLUTE DIAMETER (CALIBERS)

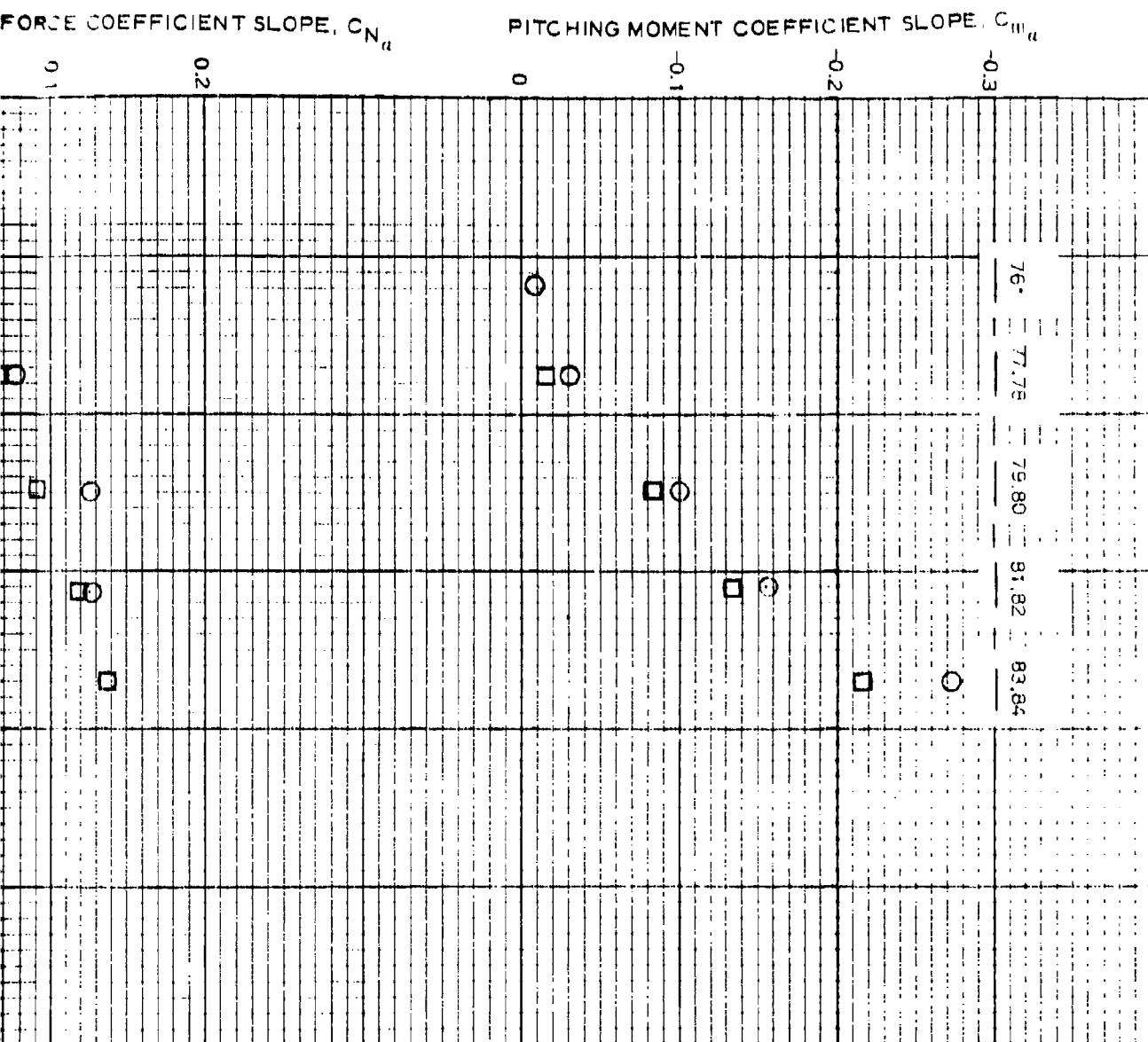
0 1.0 1.2 1.6 2.0 2.4

WITHOUT FENCE
WITH FENCE

*READ DIRECTLY BELOW CONFIGURATION NUMBER TO
OBSERVE DATA FOR THAT CONFIGURATION.

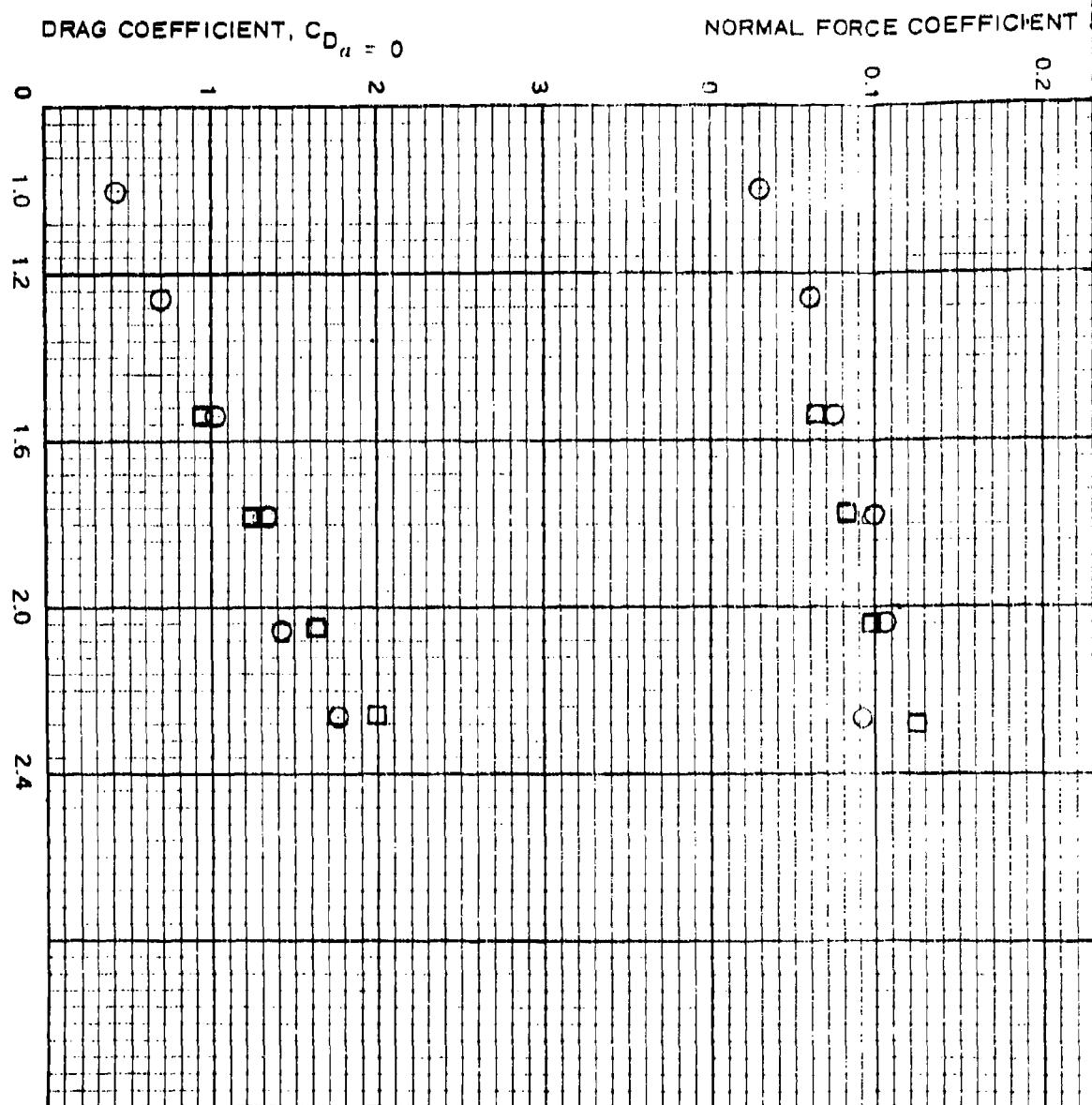
$$S_{REF} = \frac{\pi D^2}{4} \text{ CYLINDER}$$

$'_{REF}$ = D CYLINDER



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permit fully legible reproduction

Figure 278. Effect of Bubble Fence on Static Aerodynamics
of Various Size Ballutes (Continued)



- WITHOUT FENCE
 - WITH FENCE
- * READ DIRECTLY BELOW A CONFIGURATION NUMBER TO
OBSERVE DATA FOR THAT CONFIGURATION.

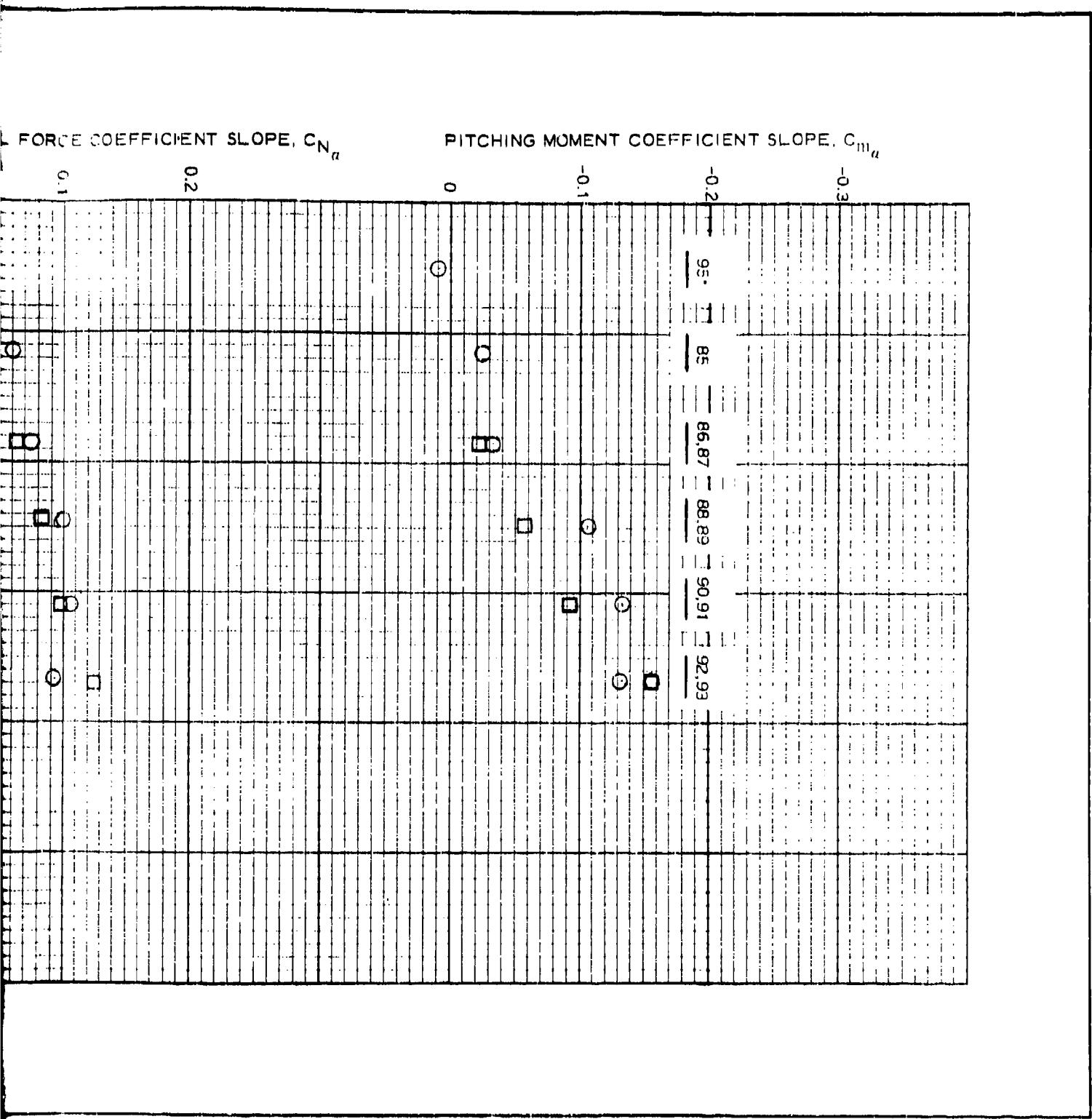
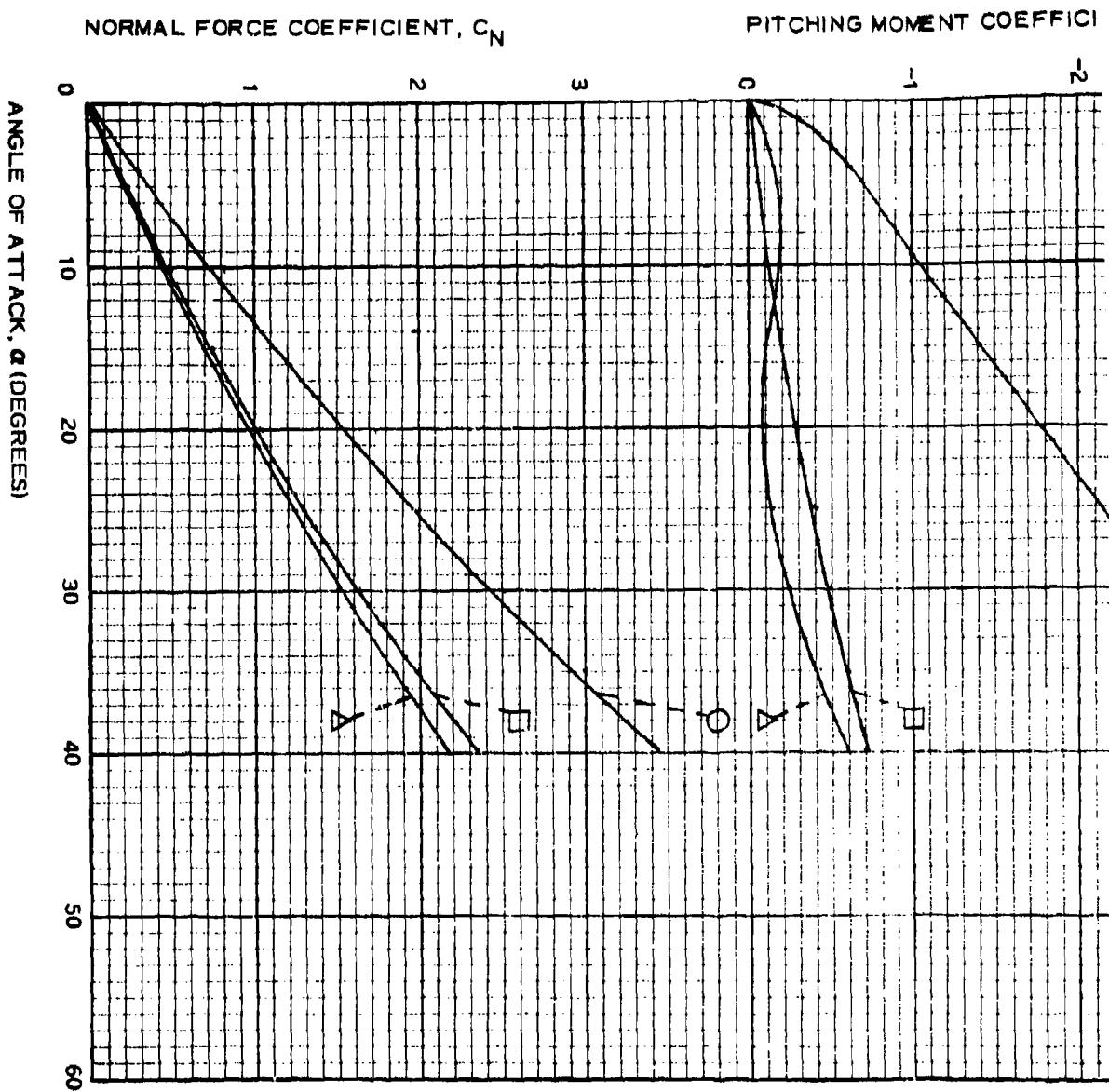


Figure 278. Effect of Burble Fence on Static Aerodynamics of Various Size Ballutes (Concluded)



SYMBOL	CONFIGURATION	$S_{REF} = \frac{\pi D^2}{4}$ CYLINDER	$S_{REF} = D$ CYLINDER
39			
38			
37			

NG MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

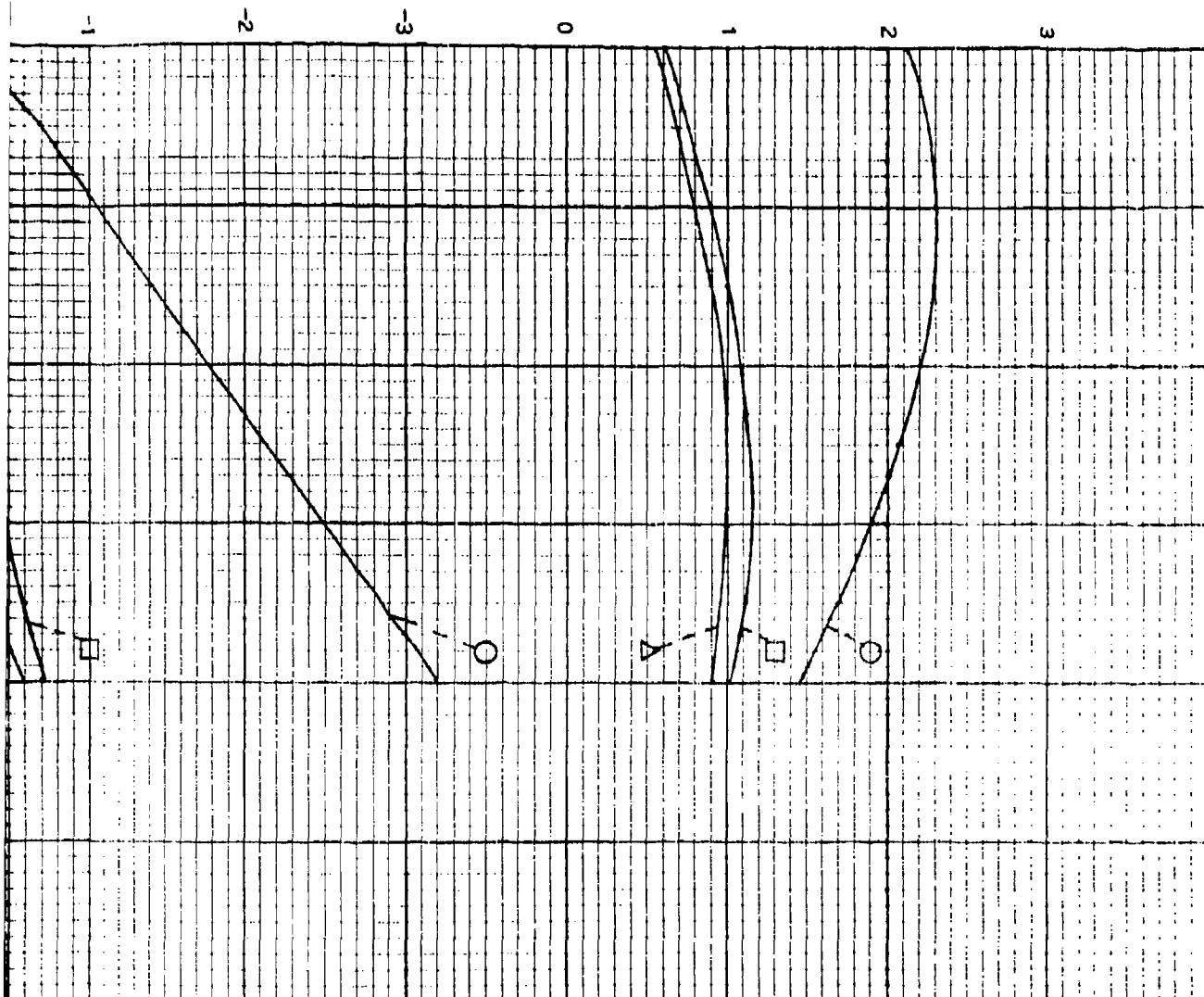
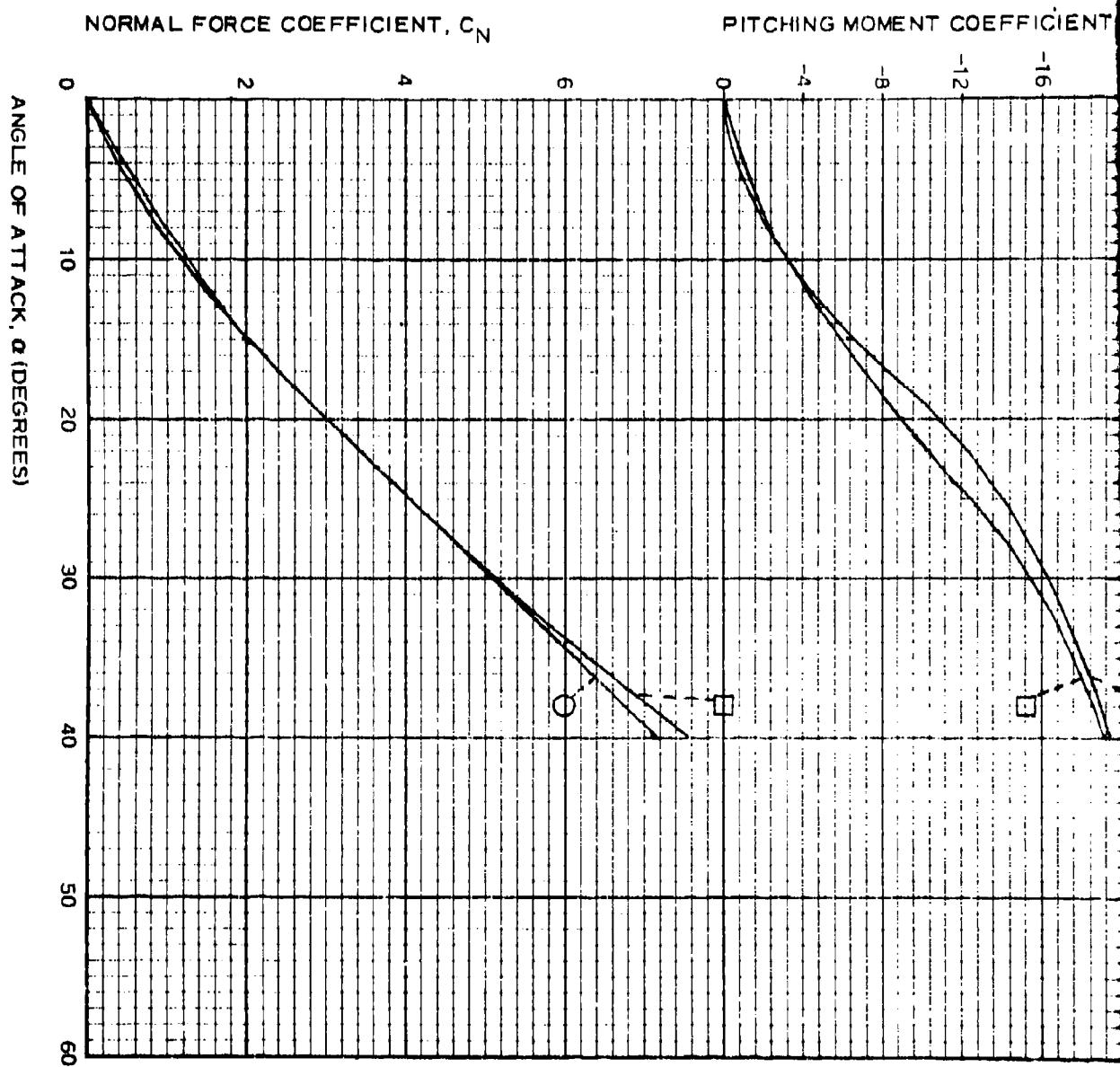


Figure 279. Effect of Small Ballutes on Static Aerodynamics of a Short Blunt Configuration



SYM- BOL	CONFIG- URATION	TRIP RING	$S_{REF} = \frac{\pi D^2}{4}$ CYLINDER	$S_{REF} = D$ CYLINDER
13		1.10 CAL TRIP RING		
10		NO TRIP RING		

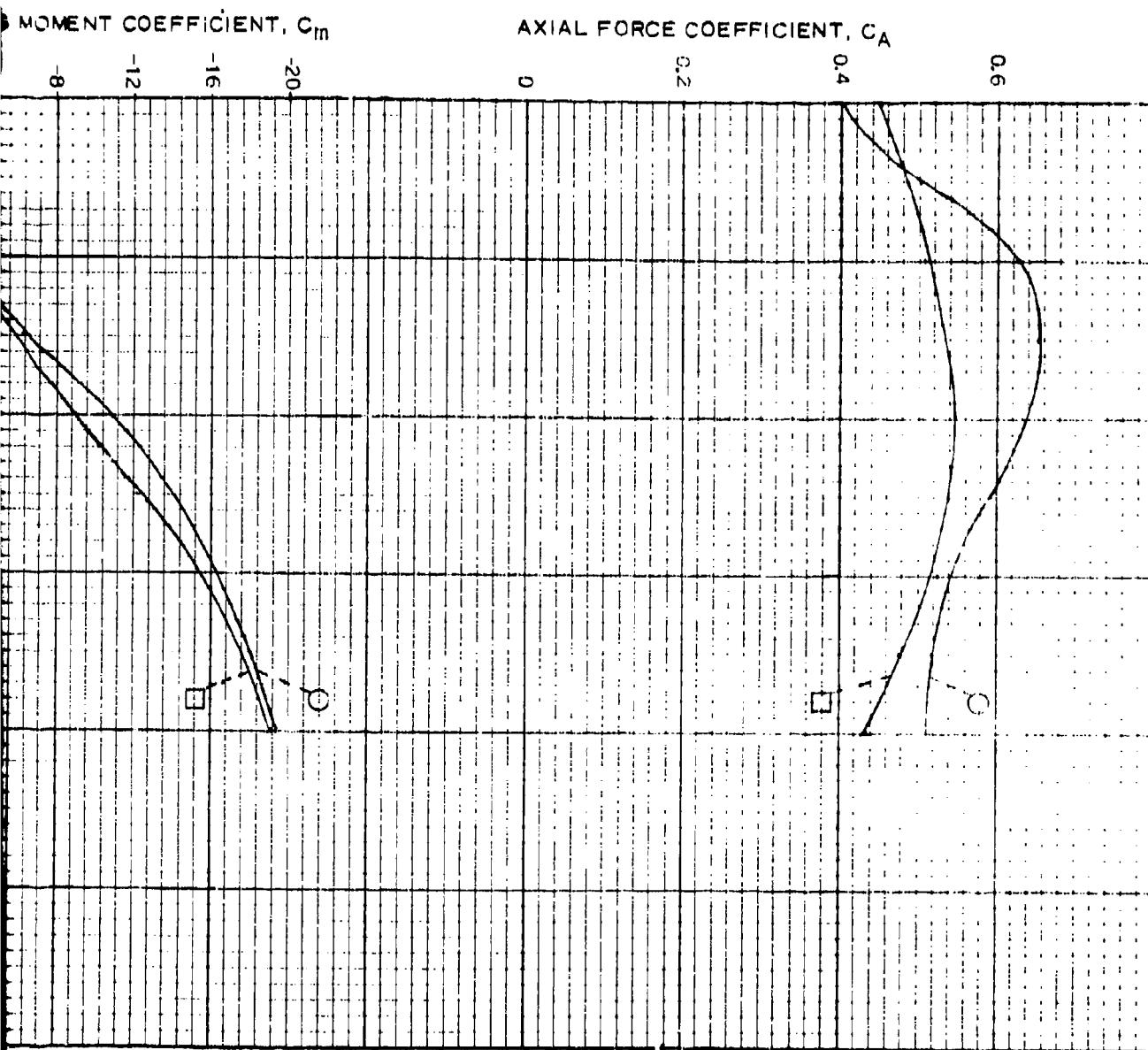
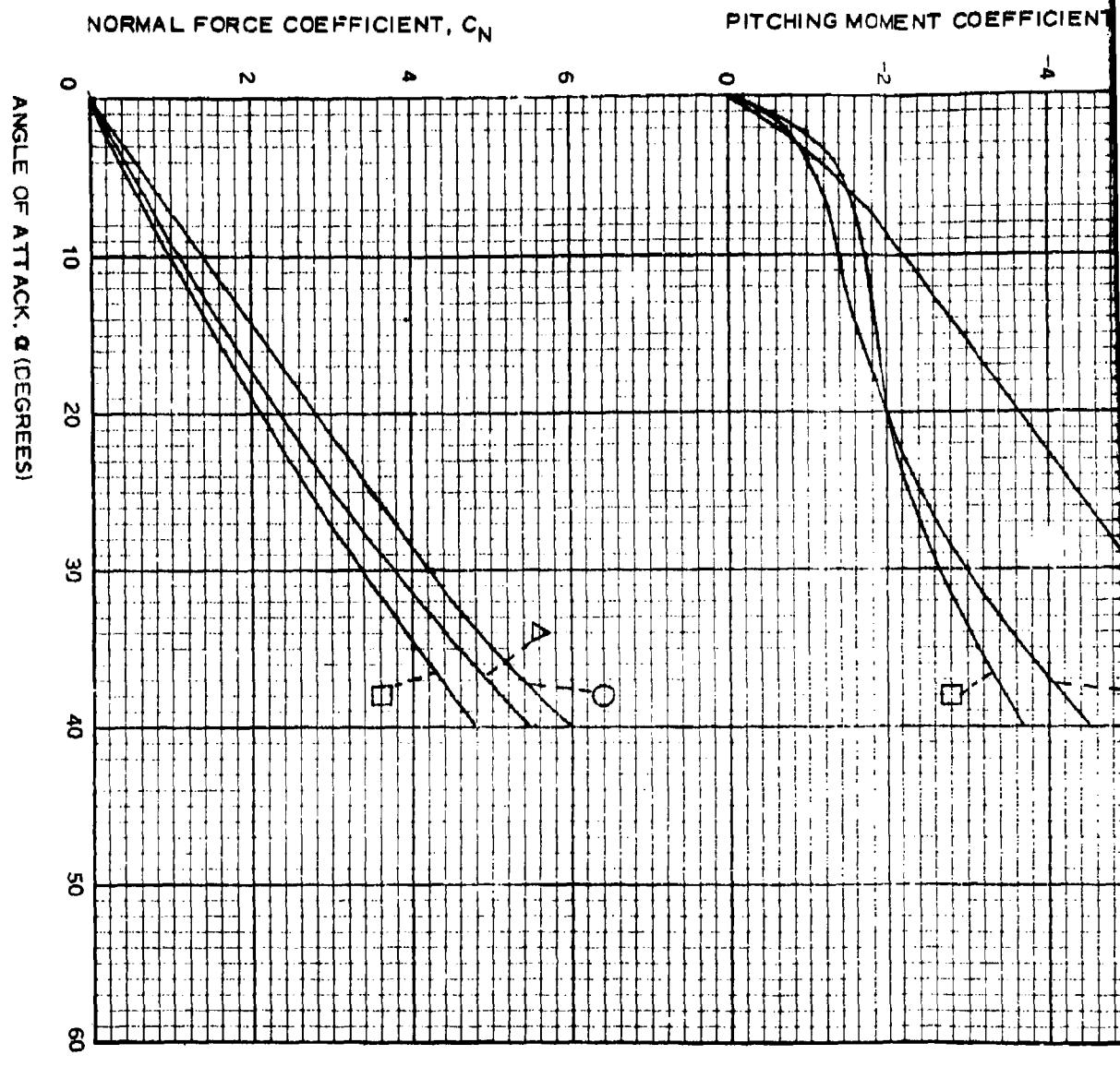


Figure 280. Effect of a Nose Trip Ring on the Static Aerodynamics of a Flat-Nosed 10-Caliber Bomb with Rigid (M118) Fins



<u>SYM-</u> <u>BOL-</u>	<u>CONFIG-</u> <u>URATION</u>	<u>BURBLE FENCE</u> <u>DIAMETER</u> <u>(CAL)</u>	<u>BURBLE FENCE</u> <u>LOCATION</u> <u>(CAL)</u>
17		2.27	0.27 AFT OF MAX DIAMETER
16		2.60	AT MAXIMUM DIAMETER
15		2.24	AT MAXIMUM DIAMETER

MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

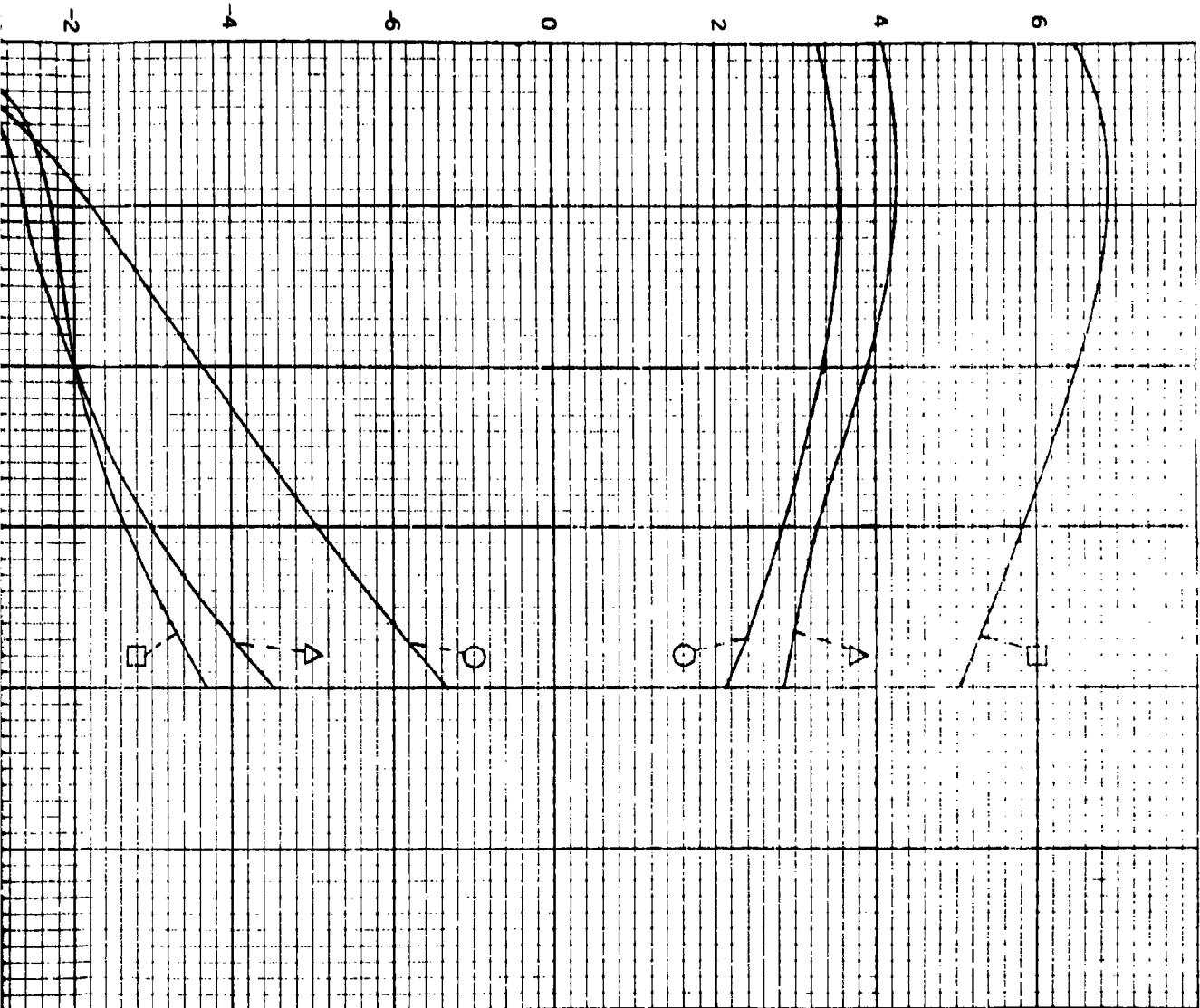
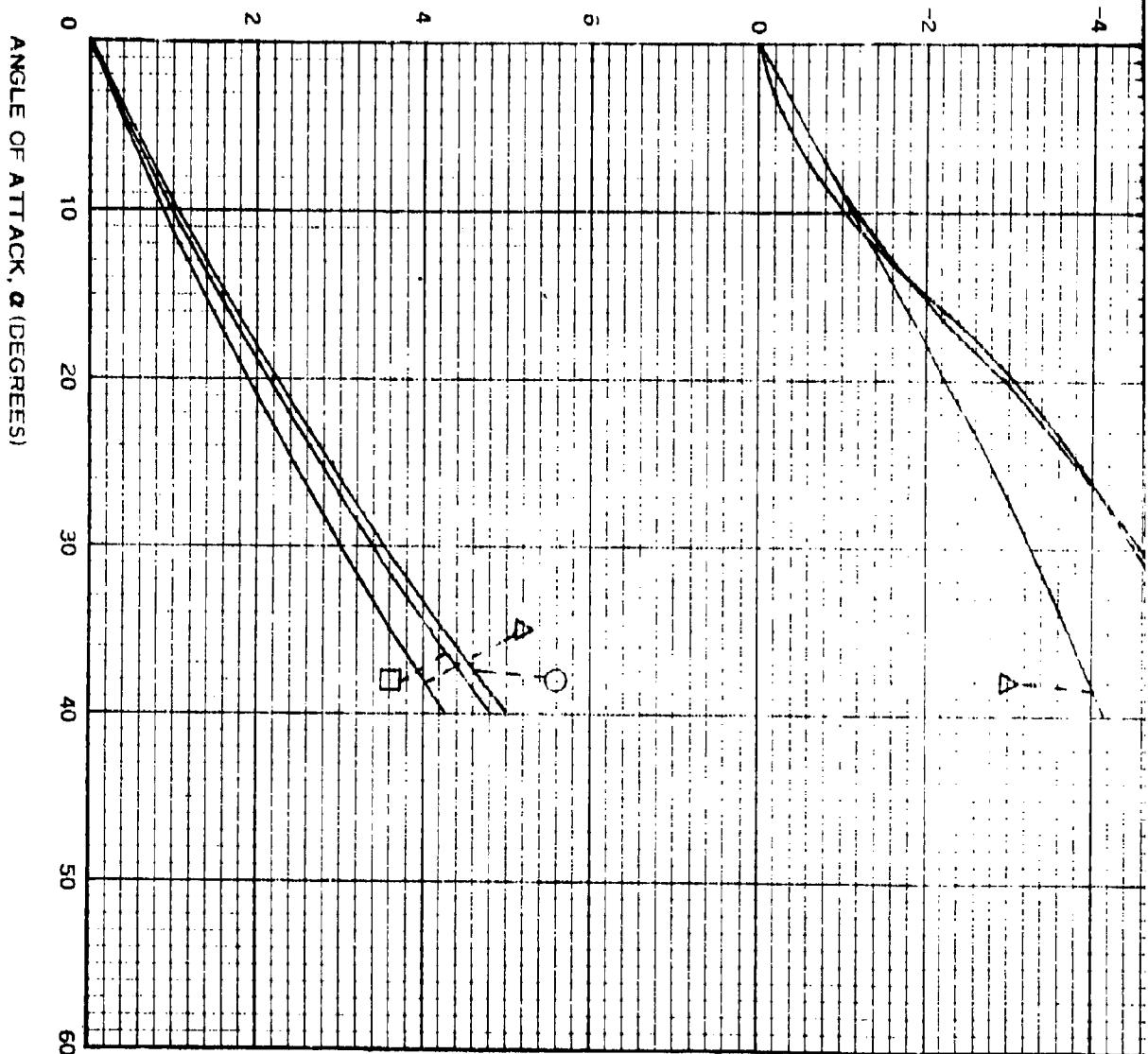


Figure 281. Effect of Burble Fence Size and Location on the Static Aerodynamics of a 5.65-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip Ring and 2.0-Caliber Ballute Stabilizer

NORMAL FORCE COEFFICIENT, C_N PITCHING MOMENT COEFFICIENT, C_M ANGLE OF ATTACK, α (DEGREES)

SYM- BOL	CONFIG- URATION	STRAKES SIZE ON 1/2/3 CAL BOAT TAIL
47	FULL	
46	0.05 CAL HIGH	
45	NONE	

$$S_{REF} = \frac{\pi D^2}{4} \text{ CYLINDER}$$

$$S_{REF} = D_{CYLINDER}$$

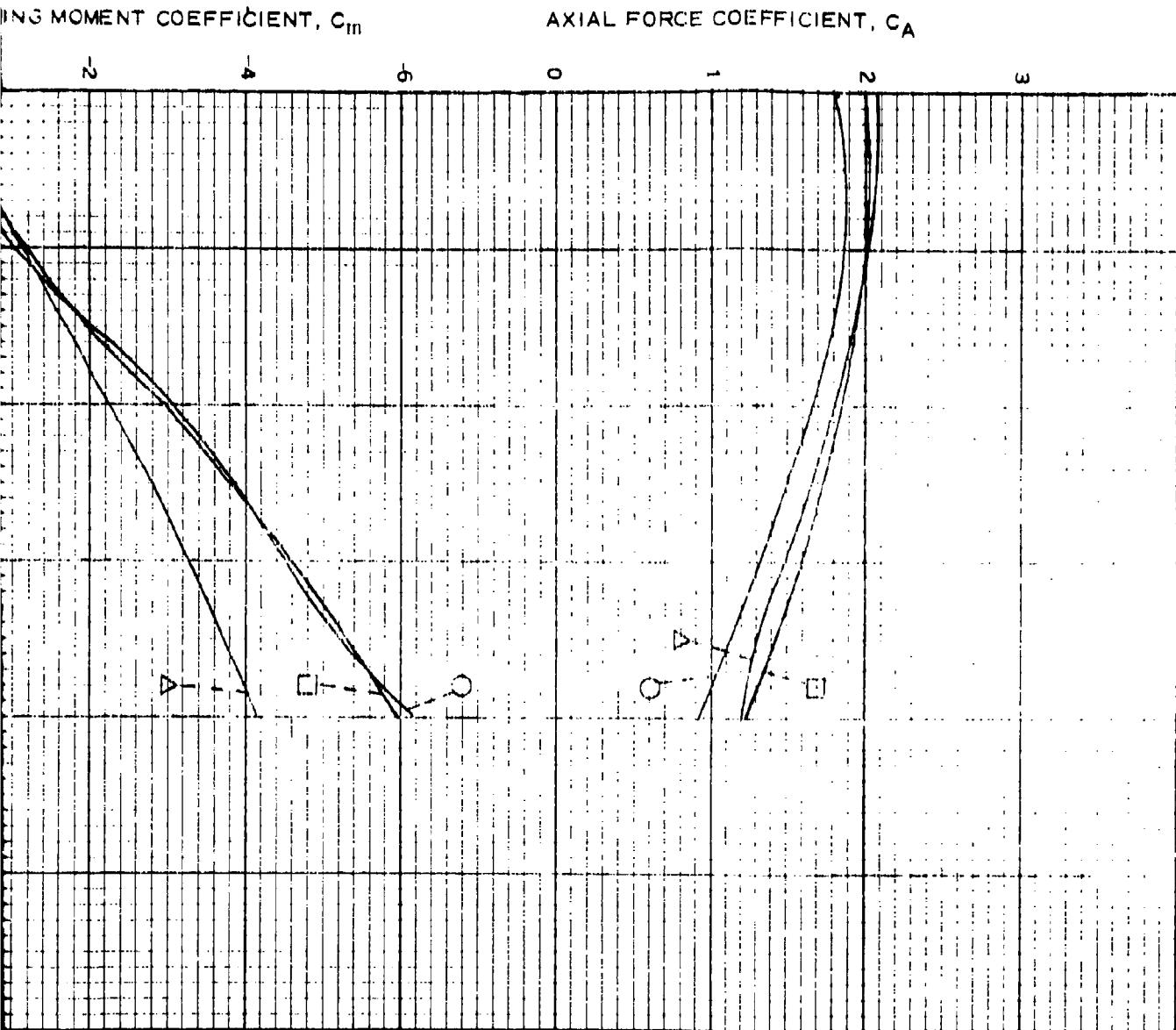
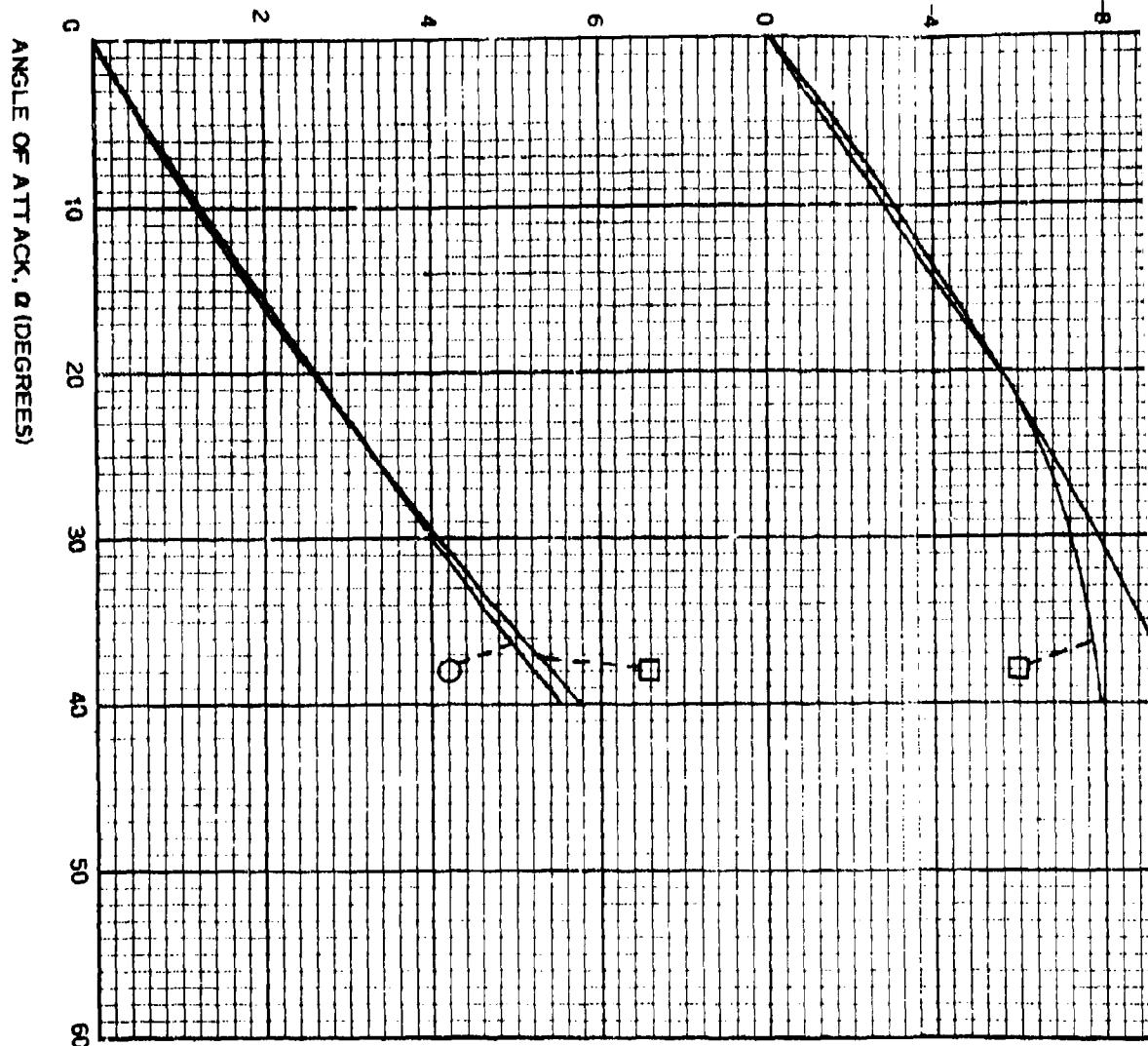


Figure 282. Effect of Strakes at 1-2/3-Caliber Boattail on the Static Aerodynamics of a 2.0-Caliber Ogive-Nosed 7.7-Caliber Bomb and 1-1/2-Caliber Ballute with 1.79-Caliber Fence

NORMAL FORCE COEFFICIENT, C_N

PITCHING MOMENT COEFFICIENT



SYM- BOL	CONFIG- URATION	BOATTAIL LENGTH (CAL)	CONE ANGLE (DEG)
53		1-2/3	10
51	1		10

$$S_{REF} = \frac{\pi D^2}{4}$$

S_{REF} = D CYLINDER

WING MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

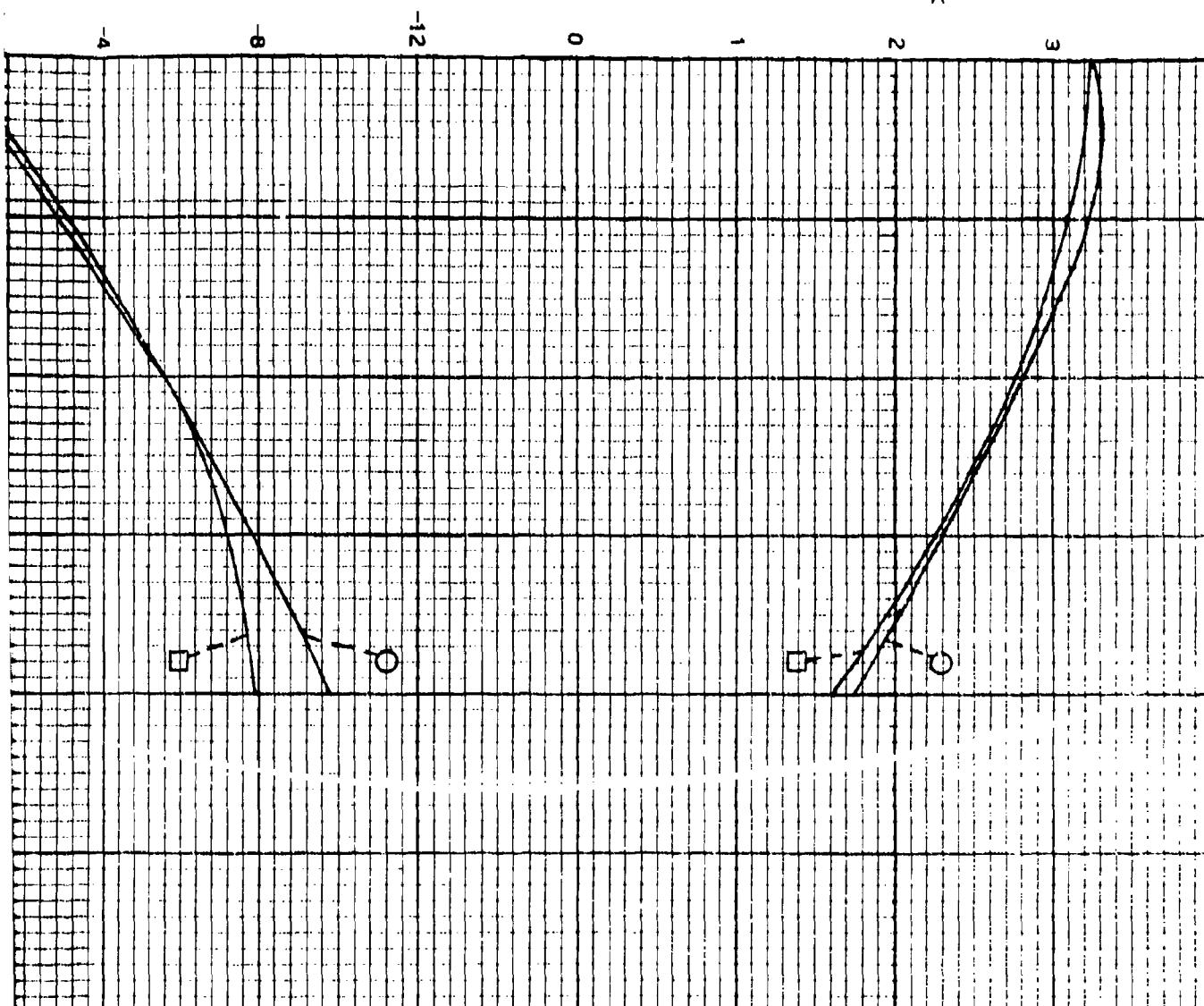
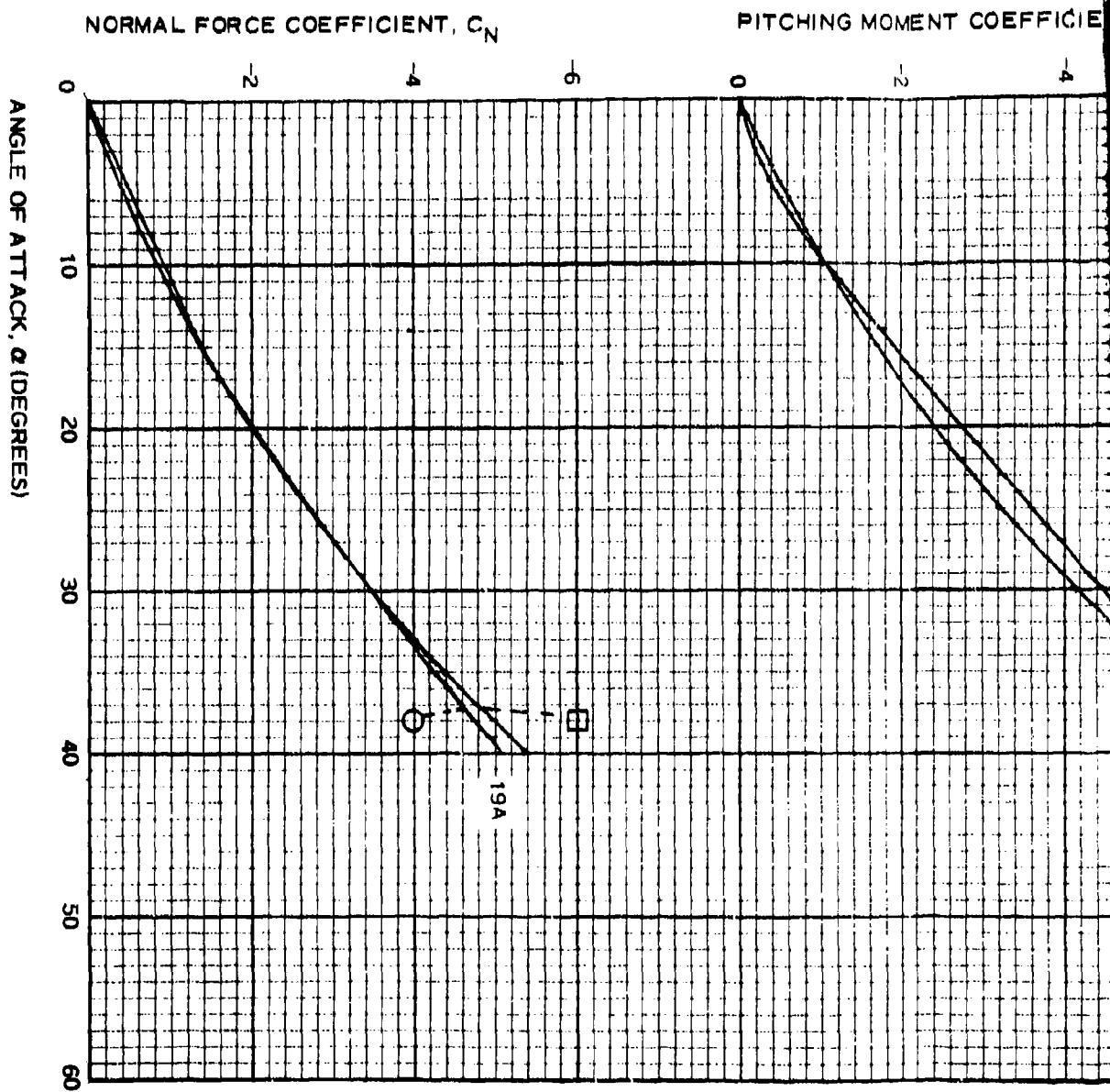


Figure 283. Effect of Boattail Length without Strakes on the Static Aerodynamics of a 2.0-Caliber Ogive-Nosed 7.7-Caliber Bomb and 2.0-Caliber Ballute Stabilizer with 2.27-Caliber Fence

<u>SYM</u>	<u>CONFIG-</u>	<u>BOAT-TAIL</u>	<u>CONE ANGLE</u>	<u>$S_{REF} = \frac{\pi D^2}{4}$</u>
<u>BOL</u>	<u>URATI</u>	<u>LENGTH (CAL)</u>	<u>(DEG)</u>	<u>CYLINDER</u>
□	O	47	1-2/3	10
		43	1-1/3	10

$\int_{REF} = D \text{ CYLINDER}$



WING MOMENT COEFFICIENT, C_m

AXIAL FORCE COEFFICIENT, C_A

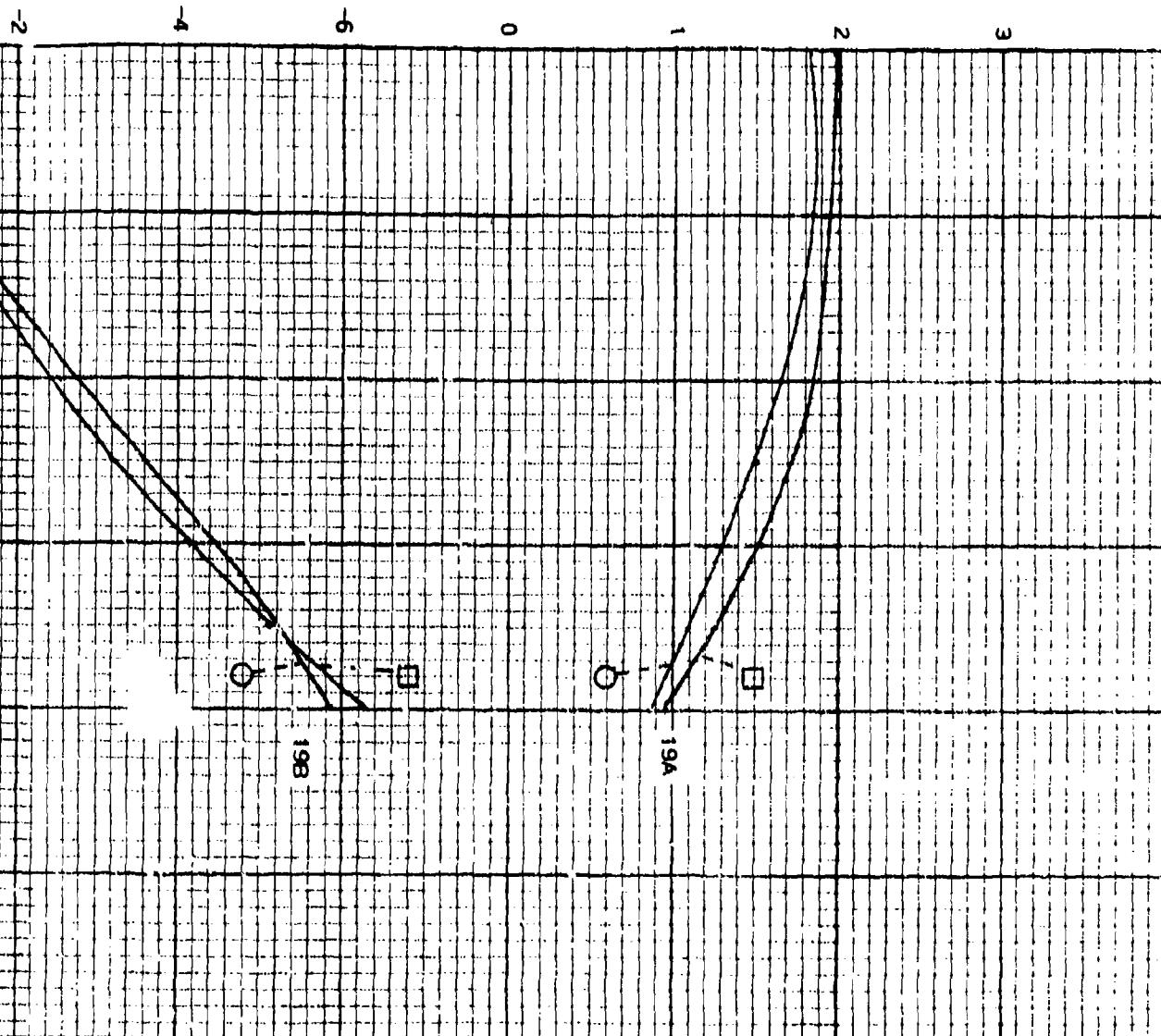


Figure 284. Effect of Boattail Length with Full Strakes on the Static Aerodynamics of a 2.0-Caliber Ogive-Nosed 7.7-Caliber Bomb and 1-1/2-Caliber Ballute Stabilizer with 1.79-Caliber Fence

		CONFIGURATION NUMBER																			
MODEL CHARACTERISTICS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NOSE GEOMETRY	Ogive																				
	1 CALIBER LONG																				
	2 CALIBERS LONG																				
	3 CALIBERS LONG																				
CONE																					
90 DEG																					
60 DEG																					
30 DEG																					
FLAT WITH 0.1 CALIBER RADIUS																					
PLAIN																					
HEMISPHERE																					
FINENESS RATIO (EXCLUDING INFLATABLE)																					
1 TO 4																					
4 TO 6																					
6 TO 8																					
8 TO 10																					
10 TO 12																					
AFTER SECTION GEOMETRY																					
1 CALIBER CYLINDER																					
1.1 CALIBER CYLINDER																					
BOAT TAIL																					
1 CALIBER LONG																					
STRAKES																					
NONE																					
0.05 CALIBER 8																					
FULL DIAMETER 8																					
1-2 CALIBER 12.5																					
STRAKES																					
NONE																					
0.05 CALIBER 3																					
FULL DIAMETER 10																					
STABILIZER																					
NONE																					
BALLUTE																					
1 CALIBER DIAMETER																					
1-1.4 CALIBER DIAMETER																					
1.1-2 CALIBER DIAMETER																					

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STRAKES

ACNE
0.05 CALIBER DIA.
FULL DIAMETER

STABILIZER

NONE

BALLUTE

1 CALIBER DIAMETER

1-1 4 CALIBER DIAMETER

1-1 2 CALIBER DIAMETER

1-3 4 CALIBER DIAMETER

2 CALIBER DIAMETER

2-1 4 CALIBER DIAMETER

EURBLE FENCE

NONE

AT MAX BALLUTE DIAMETER
SET BACK

1-1 4 CALIBER DIAMETER

1-1 2 CALIBER DIAMETER

1-3 4 CALIBER DIAMETER

2 CALIBER DIAMETER

2-1 4 CALIBER DIAMETER

2-3 8 CALIBER DIAMETER

2-1 2 CALIBER DIAMETER

2-5 8 CALIBER DIAMETER

MISCELLANEOUS:INFLATABLE
CONCAVE EXTENSION. 3 4 CAL
PLAIN

4 PANELS

CONCAVE EXTENSION 1 CAL
WITH TORUS NO PANELS

WITH TORUS 4 PANELS

1-1 4 CALIBER DIAMETER TORUS

1-1 2 CAL SPAN CONICAL FINS

1-7 8 CAL SPAN 2-CELL FINS

1-2 3 CALIBER PARATAIL

RIGID FIN

1 5 CAL SPAN FINS (M:118)
1 CAL SPAN FINS (BLD:27 E)AeroDynamic Data
for Configuration Number →

20	25	30	34	36	37	38	46	51	57	58	63	66	73	78	83	86	87
21	26	31	35	37	38	39	47	52	58	59	64	69	74	79	84	88	
22	27	32	36	38	39	40	48	53	59	60	65	70	75	80	85	89	
23	28	33	37	39	40	41	49	54	61	62	67	71	76	81	86	90	
24	29	34	38	40	41	42	50	55	62	63	68	72	77	82	87		

Figure 285. Configuration Characteristics Identification Index

Figure 285. Configuration Characteristics Identification Index (Continued)

		CONFIGURATION NUMBER																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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472	476 TO 478	482 TO 484	488 TO 486	494 TO 496	500 TO 502	506 TO 508	514 TO 516	520 TO 522	526 TO 528	530 TO 532	534 TO 536	540 TO 542	546 TO 548	550 TO 552	554 TO 556	558 TO 560	564 TO 566	570 TO 572	576 TO 578	582 TO 584	588 TO 586	594 TO 596	600 TO 602	606 TO 608	614 TO 616	620 TO 622	626 TO 628	630 TO 632	634 TO 636	640 TO 642	646 TO 648	650 TO 652	654 TO 656	658 TO 660	664 TO 666	670 TO 672	676 TO 678	682 TO 684	688 TO 686	694 TO 696	700 TO 702	706 TO 708	714 TO 716	720 TO 722	726 TO 728	730 TO 732	734 TO 736	740 TO 742	746 TO 748	750 TO 752	754 TO 756	758 TO 760	764 TO 766	770 TO 772	776 TO 778	782 TO 784	788 TO 786	794 TO 796	800 TO 802	806 TO 808	814 TO 816	820 TO 822	826 TO 828	830 TO 832	834 TO 836	840 TO 842	846 TO 848	850 TO 852	854 TO 856	858 TO 860	864 TO 866	870 TO 872	876 TO 878	882 TO 884	888 TO 886	894 TO 896	900 TO 902	906 TO 908	914 TO 916	920 TO 922	926 TO 928	930 TO 932	934 TO 936	940 TO 942	946 TO 948	950 TO 952	954 TO 956	958 TO 960	964 TO 966	970 TO 972	976 TO 978	982 TO 984	988 TO 986	994 TO 996	1000 TO 1002	1006 TO 1008	1014 TO 1016	1020 TO 1022	1026 TO 1028	1030 TO 1032	1034 TO 1036	1040 TO 1042	1046 TO 1048	1050 TO 1052	1054 TO 1056	1058 TO 1060	1064 TO 1066	1070 TO 1072	1076 TO 1078	1082 TO 1084	1088 TO 1086	1094 TO 1096	1100 TO 1102	1106 TO 1108	1114 TO 1116	1120 TO 1122	1126 TO 1128	1130 TO 1132	1134 TO 1136	1140 TO 1142	1146 TO 1148	1150 TO 1152	1154 TO 1156	1158 TO 1160	1164 TO 1166	1170 TO 1172	1176 TO 1178	1182 TO 1184	1188 TO 1186	1194 TO 1196	1200 TO 1202	1206 TO 1208	1214 TO 1216	1220 TO 1222	1226 TO 1228	1230 TO 1232	1234 TO 1236	1240 TO 1242	1246 TO 1248	1250 TO 1252	1254 TO 1256	1258 TO 1260	1264 TO 1266	1270 TO 1272	1276 TO 1278	1282 TO 1284	1288 TO 1286	1294 TO 1296	1300 TO 1302	1306 TO 1308	1314 TO 1316	1320 TO 1322	1326 TO 1328	1330 TO 1332	1334 TO 1336	1340 TO 1342	1346 TO 1348	1350 TO 1352	1354 TO 1356	1358 TO 1360	1364 TO 1366	1370 TO 1372	1376 TO 1378	1382 TO 1384	1388 TO 1386	1394 TO 1396	1400 TO 1402	1406 TO 1408	1414 TO 1416	1420 TO 1422	1426 TO 1428	1430 TO 1432	1434 TO 1436	1440 TO 1442	1446 TO 1448	1450 TO 1452	1454 TO 1456	1458 TO 1460	1464 TO 1466	1470 TO 1472	1476 TO 1478	1482 TO 1484	1488 TO 1486	1494 TO 1496	1500 TO 1502	1506 TO 1508	1514 TO 1516	1520 TO 1522	1526 TO 1528	1530 TO 1532	1534 TO 1536	1540 TO 1542	1546 TO 1548	1550 TO 1552	1554 TO 1556	1558 TO 1560	1564 TO 1566	1570 TO 1572	1576 TO 1578	1582 TO 1584	1588 TO 1586	1594 TO 1596	1600 TO 1602	1606 TO 1608	1614 TO 1616	1620 TO 1622	1626 TO 1628	1630 TO 1632	1634 TO 1636	1640 TO 1642	1646 TO 1648	1650 TO 1652	1654 TO 1656	1658 TO 1660	1664 TO 1666	1670 TO 1672	1676 TO 1678	1682 TO 1684	1688 TO 1686	1694 TO 1696	1700 TO 1702	1706 TO 1708	1714 TO 1716	1720 TO 1722	1726 TO 1728	1730 TO 1732	1734 TO 1736	1740 TO 1742	1746 TO 1748	1750 TO 1752	1754 TO 1756	1758 TO 1760	1764 TO 1766	1770 TO 1772	1776 TO 1778	1782 TO 1784	1788 TO 1786	1794 TO 1796	1800 TO 1802	1806 TO 1808	1814 TO 1816	1820 TO 1822	1826 TO 1828	1830 TO 1832	1834 TO 1836	1840 TO 1842	1846 TO 1848	1850 TO 1852	1854 TO 1856	1858 TO 1860	1864 TO 1866	1870 TO 1872	1876 TO 1878	1882 TO 1884	1888 TO 1886	1894 TO 1896	1900 TO 1902	1906 TO 1908	1914 TO 1916	1920 TO 1922	1926 TO 1928	1930 TO 1932	1934 TO 1936	1940 TO 1942	1946 TO 1948	1950 TO 1952	1954 TO 1956	1958 TO 1960	1964 TO 1966	1970 TO 1972	1976 TO 1978	1982 TO 1984	1988 TO 1986	1994 TO 1996	2000 TO 2002	2006 TO 2008	2014 TO 2016	2020 TO 2022	2026 TO 2028	2030 TO 2032	2034 TO 2036	2040 TO 2042	2046 TO 2048	2050 TO 2052	2054 TO 2056	2058 TO 2060	2064 TO 2066	2070 TO 2072	2076 TO 2078	2082 TO 2084	2088 TO 2086	2094 TO 2096	2100 TO 2102	2106 TO 2108	2114 TO 2116	2120 TO 2122	2126 TO 2128	2130 TO 2132	2134 TO 2136	2140 TO 2142	2146 TO 2148	2150 TO 2152	2154 TO 2156	2158 TO 2160	2164 TO 2166	2170 TO 2172	2176 TO 2178	2182 TO 2184	2188 TO 2186	2194 TO 2196	2200 TO 2202	2206 TO 2208	2214 TO 2216	2220 TO 2222	2226 TO 2228	2230 TO 2232	2234 TO 2236	2240 TO 2242	2246 TO 2248	2250 TO 2252	2254 TO 2256	2258 TO 2260	2264 TO 2266	2270 TO 2272	2276 TO 2278	2282 TO 2284	2288 TO 2286	2294 TO 2296	2300 TO 2302	2306 TO 2308	2314 TO 2316	2320 TO 2322	2326 TO 2328	2330 TO 2332	2334 TO 2336	2340 TO 2342	2346 TO 2348	2350 TO 2352	2354 TO 2356	2358 TO 2360	2364 TO 2366	2370 TO 2372	2376 TO 2378	2382 TO 2384	2388 TO 2386	2394 TO 2396	2400 TO 2402	2406 TO 2408	2414 TO 2416	2420 TO 2422	2426 TO 2428	2430 TO 2432	2434 TO 2436	2440 TO 2442	2446 TO 2448	2450 TO 2452	2454 TO 2456	2458 TO 2460	2464 TO 2466	2470 TO 2472	2476 TO 2478	2482 TO 2484	2488 TO 2486	2494 TO 2496	2500 TO 2502	2506 TO 2508	2514 TO 2516	2520 TO 2522	2526 TO 2528	2530 TO 2532	2534 TO 2536	2540 TO 2542	2546 TO 2548	2550 TO 2552	2554 TO 2556	2558 TO 2560	2564 TO 2566	2570 TO 2572	2576 TO 2578	2582 TO 2584	2588 TO 2586	2594 TO 2596	2600 TO 2602	2606 TO 2608	2614 TO 2616	2620 TO 2622	2626 TO 2628	2630 TO 2632	2634 TO 2636	2640 TO 2642	2646 TO 2648	2650 TO 2652	2654 TO 2656	2658 TO 2660	2664 TO 2666	2670 TO 2672	2676 TO 2678	2682 TO 2684	2688 TO 2686	2694 TO 2696	2700 TO 2702	2706 TO 2708	2714 TO 2716	2720 TO 2722	2726 TO 2728	2730 TO 2732	2734 TO 2736	2740 TO 2742	2746 TO 2748	2750 TO 2752	2754 TO 2756	2758 TO 2760	2764 TO 2766	2770 TO 2772	2776 TO 2778	2782 TO 2784	2788 TO 2786	2794 TO 2796	2800 TO 2802	2806 TO 2808	2814 TO 2816	2820 TO 2822	2826 TO 2828	2830 TO 2832	2834 TO 2836	2840 TO 2842	2846 TO 2848	2850 TO 2852	2854 TO 2856	2858 TO 2860	2864 TO 2866	2870 TO 2872	2876 TO 2878	2882 TO 2884	2888 TO 2886	2894 TO 2896	2900 TO 2902	2906 TO 2908	2914 TO 2916	2920 TO 2922	2926 TO 2928	2930 TO 2932	2934 TO 2936	2940 TO 2942	2946 TO 2948	2950 TO 2952	2954 TO 2956	2958 TO 2960	2964 TO 2966	2970 TO 2972	2976 TO 2978	2982 TO 2984	2988 TO 2986	2994 TO 2996	3000 TO 3002	3006 TO 3008	3014 TO 3016	3020 TO 3022	3026 TO 3028	3030 TO 3032	3034 TO 3036	3040 TO 3042	3046 TO 3048	3050 TO 3052	3054 TO 3056	3058 TO 3060	3064 TO 3066	3070 TO 3072	3076 TO 3078	3082 TO 3084	3088 TO 3086	3094 TO 3096	3100 TO 3102	3106 TO 3108	3114 TO 3116	3120 TO 3122	3126 TO 3128	3130 TO 3132	3134 TO 3136	3140 TO 3142	3146 TO 3148	3150 TO 3152	3154 TO 3156	3158 TO 3160	3164 TO 3166	3170 TO 3172	3176 TO 3178	3182 TO 3184	3188 TO 3186	3194 TO 3196	3200 TO 3202	3206 TO 3208	3214 TO 3216	3220 TO 3222	3226 TO 3228	3230 TO 3232	3234 TO 3236	3240 TO 3242	3246 TO 3248	3250 TO 3252	3254 TO 3256	3258 TO 3260	3264 TO 3266	3270 TO 3272	3276 TO 3278	3282 TO 3284	3288 TO 3286	3294 TO 3296	3300 TO 3302	3306 TO 3308	3314 TO 3316	3320 TO 3322	3326 TO 3328	3330 TO 3332	3334 TO 3336	3340 TO 3342	3346 TO 3348	3350 TO 3352	3354 TO 3356	3358 TO 3360	3364 TO 3366	3370 TO 3372	3376 TO 3378	3382 TO 3384	3388 TO 3386	3394 TO 3396	3400 TO 3402	3406 TO 3408	3414 TO 3416	3420 TO 3422	3426 TO 3428	3430 TO 3432	3434 TO 3436	3440 TO 3442	3446 TO 3448	3450 TO 3452	3454 TO 3456	3458 TO 3460	3464 TO 3466	3470 TO 3472	3476 TO 3478	3482 TO 3484	3488 TO 3486	3494 TO 3496	3500 TO 3502	3506 TO 3508	3514 TO 3516	3520 TO 3522	3526 TO 3528	3530 TO 3532	3534 TO 3536	3540 TO 3542	3546 TO 3548	3550 TO 3552	3554 TO 3556	3558 TO 3560	3564 TO 3566	3570 TO 3572	3576 TO 3578	3582 TO 3584	3588 TO 3586	3594 TO 3596	3600 TO 3602	3606 TO 3608	3614 TO 3616	3620 TO 3622	3626 TO 3628	3630 TO 3632	3634 TO 3636	3640 TO 3642	3646 TO 3648	3650 TO 3652	3654 TO 3656	3658 TO 3660	3664 TO 3666	3670 TO 3672	3676 TO 3678	3682 TO 3684	3688 TO 3686	3694 TO 3696	3700 TO 3702	3706 TO 3708	3714 TO 3716	3720 TO 3722	3726 TO 3728	3730 TO 3732	3734 TO 3736	3740 TO 3742	3746 TO 3748	3750 TO 3752	3754 TO 3756	3758 TO 3760	3764 TO 3766	3770 TO 3772	3776 TO 3778	3782 TO 3784	3788 TO 3786	3794 TO 3796	3800 TO 3802	3806 TO 3808	3814 TO 3816	3820 TO 3822	3826 TO 3828	3830 TO 3832	3834 TO 3836	3840 TO 3842	3846 TO 3848	3850 TO 3852	3854 TO 3856	3858 TO 3860	3864 TO 3866	3870 TO 3872	3876

Figure 285. Configuration Characteristics Identification Index (Continued)

Figure 285 Configuration Characteristics Identification Index (Continued)

Figure 285. Configuration Characteristics Identification Index (Continued)

STRAKES		Aerodynamic Data																				
NONE		for Configuration Number →																				
0.05 CALIBER (8)		Configuration Specification pp																				
FULL DIAMETER (8)		Static Coefficients (Digital) pp																				
STABILIZER		Static Coefficients (Graphic) pp																				
NONE		Dynamic Coefficients (Digital) pp																				
GALLUTE		Dynamic Coefficients (Graphic) pp																				
4 CALIBER DIAMETER		Aerodynamic Data																				
5 CALIBER DIAMETER		for Configuration Number →																				
1-1/2 CALIBER DIAMETER		Configuration Specification pp																				
1-3/4 CALIBER DIAMETER		Static Coefficients (Digital) pp																				
2 CALIBER DIAMETER		Static Coefficients (Graphic) pp																				
2-1/4 CALIBER DIAMETER		Dynamic Coefficients (Digital) pp																				
BURBLE FENCE		Dynamic Coefficients (Graphic) pp																				
NONE		Aerodynamic Data																				
AT MAX BALLUTE DIAMETER		for Configuration Number →																				
SET BACK		Configuration Specification pp																				
5-3 CALIBER DIAMETER		Static Coefficients (Digital) pp																				
1-1/2 CALIBER DIAMETER		Static Coefficients (Graphic) pp																				
1-3/4 CALIBER DIAMETER		Dynamic Coefficients (Digital) pp																				
2 CALIBER DIAMETER		Dynamic Coefficients (Graphic) pp																				
2-1/4 CALIBER DIAMETER		Aerodynamic Data																				
2-3/8 CALIBER DIAMETER		for Configuration Number →																				
2-1/2 CALIBER DIAMETER		Configuration Specification pp																				
4-3 CALIBER DIAMETER		Static Coefficients (Digital) pp																				
MISCELLANEOUS INFLATABLE		Aerodynamic Data																				
CONCAVE EXTENSION, 3 CAL		for Configuration Number →																				
PLAIN		Configuration Specification pp																				
4 PANELS		Static Coefficients (Digital) pp																				
CONCAVE EXTENSION, 1 CAL		Aerodynamic Data																				
WITH TORUS, NO PANELS		for Configuration Number →																				
WITH TORUS, 4 PANELS		Configuration Specification pp																				
1-1/4 CALIBER DIAMETER TORUS		Static Coefficients (Digital) pp																				
1-1/2 CALIBER CONICAL FINS		Aerodynamic Data																				
1-7/8 CALIBER 2-CELL FINS		for Configuration Number →																				
1-2/3 CALIBER PARATAIL		Configuration Specification pp																				
RIGID FIN		Static Coefficients (Digital) pp																				
1.5 CAL SPAN FINS (M-118)		Aerodynamic Data																				
1 CAL SPAN FINS (BLU-27-B)		for Configuration Number →																				
Configuration Specification pp		100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	
Static Coefficients (Digital) pp		246	346	352	354	356	358	360	362	364	366	368	370	371	372	373	374	375	376	377	378	379
Static Coefficients (Graphic) pp		347	350	351	353	355	357	359	361	363	365	367	369	371	373	375	377	379	381	383	385	387
Dynamic Coefficients (Digital) pp		348	351	353	355	357	359	361	363	365	367	369	371	373	375	377	379	381	383	385	386	388

Figure 285. Configuration Characteristics Identification Index (Concluded)

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13. ABSTRACT One hundred and nineteen Ballute-stabilized bomb configurations were studied to determine the feasibility of ram air-inflated Ballutes as stabilizers or decelerators for various tactical missions. Both subsonic and transonic wind tunnel tests were conducted to define static and dynamic aerodynamic characteristics.		

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